THE LAST RITES FOR OUR DEAN

Simplicity and dignity marked the last services for our well-loved Dean. On July twenty-three his body was brought back to the College he served so ably and loyally. At the town of Los Baños the faculties and students of the three associated colleges met the hearse and followed their loved Dean over the four kilometers of road to the Campus. The road he had ridden over so many hundreds of times in the years of his work for and with us in the College. It was a stately coming home. The casket was borne to the Auditorium which loving hands with palms and flowers had made ready. Here, under guard of cadets and honor guards from the faculty, Our Dean lay in state through the evening and night.

The funeral services Sunday morning, July twenty-four, were conducted by Doctor Hamilton and Reverend Bausman of the Protestant College Church. The hymns were "Jesus Lover of My Soul" and "My Faith Looks up to Thee" and Miss Manahan sang "Saved by Grace". Doctor Hamilton's address was that of a friend talking to friends of the personal life and power of Our Dean, Our Friend—who lay so silent in the hall where he had so often made fervent appeals for the highest standards of life and service.

In early afternoon, followed by many cars filled with sorrowing faculty members and delegations of students, Our Dean, covered with masses of the flowers he knew and loved so well, left for all time this College Campus so dear to him. The funeral services in Manila on this Sunday afternoon were in the Union Church. The service, as at the College, was the simple Presbyterian ritual. The hymns sung were "Lead Kindly Light" and "Crossing the Bar". The organ prelude was Grieg's "The Death of Ase". Doctor Rodgers, an old friend of the Dean, and Doctor Cook, pastor of the Union Church, conducted the services. Doctor Cook in his address spoke especially of the Dean's life of great unselfish service. "Dean Baker is the greatest gift of America to the Filipino" was his final tribute.

After the service the casket was taken to the National Funeral Parlors. On July twenty-five the body was cremated. This was in accordance with the wish of the Dean.

On August five in the morning in the College Auditorium, Memorial Services were held. Palms and flowers made the familiar hall a fitting place in which to speak in memory of Our Dean. On the platform was

unveiled a bust of Dean Baker, which had been completed some weeks before by Mr. Villaluz, for Doctor Gonzalez. On the pedestal was a very lovely wreath of roses and a leaf of the sacred palm. No tribute could more perfectly express understanding esteem than a large butterfly wrought of flowers placed near the pedestal of the bust. This was the work of Mr. Dawis of the Agronomy Department. It was exquisitely beautiful.

Those who spoke in memory of Our Dean were Doctor Roxas and Doctor Gonzalez of our faculty, Professor Cuzner of the Forest School, Dean San Agustin of the College of Veterinary Science, Mr. Marcelo Peña, President of the Student Body, Mr. Hidrosollo of the Board of Regents, and Dean Bocobo, Acting President of the University. The music, under the direction of Professor Roa, was the organ prelude, "The Death of Ase"; Massenet's "Élégie" was sung by Miss Manahan and Gounod's "O Divine Redeemer" by Mrs. Lopez. The hymns sung were "Abide with me" and "Nearer my God to Thee."

All was simple, sincere, qualities strongly expressed by the daily life of Our Dean.

CHARLES FULLER BAKER'S FINAL CONTRIBUTION TO SCIENCE

Dean Baker was unselfish to the extreme, and lived like an ascetic. As he moved from place to place, in his service in many countries and under five governments, he frequently gave away the main portion of his library and collections as they existed at the time. He would not be bothered with a library nor with collections that were static—he was interested only in what was fresh and growing.

It is recorded that he gave away a number of collections, which include the following: In 1899, to the United States National Museum, he donated a collection of about 60,000 specimens of American Hemiptera and Hymenoptera. Thirteen years later, on leaving Pomona College to come to Los Baños, not only did he present the former College with about 75,000 specimens of American insects and an herbarium of about 200,000 sheets, but he also raised the money to enable the college to provide suitable cases for the herbarium.

After coming to Los Baños and developing the work here, he gave liberally of his collections to our College. In 1921 he presented to the Department of Plant Pathology a collection of some 15,000 Malayan fungi. In the following year he gave our Department of Botany an herbarium of about 5,000 sheets of Malayan plants.

He at one time made modest mention of "numerous lesser contributions to many institutions" which certainly includes in the total an immense quantity of material. In addition to all this there are probably well over 200,000 specimens of mycological and entomological material which have been donated to his long list of collaborators.

There is no record of the total amount of money which he sent in the form of United States paper currency every month during several post-war years to his collaborators in Central Europe. It must have been large, for at one time he told me that he was making it a practice to send over half of each month's salary.

The final chapter of his list of donations we find written in his will: His main collection, which is entomological, goes to the United States National Museum, Washington, D.C. This collection comprises over 1,450 Schmidt cases of insects, arranged in perfect order and kept in marvellously good condition. This collection is to remain in his house, exactly as he left it, until an experienced packer arrives from the Museum to pack and ship it. Dean Baker specifies every detail of the care of the collection,

even as to when the windows of the storage rooms are to be opened and closed. Some years ago this collection was estimated to be worth ₱50,000; its value at the present day is certainly much higher, because of the constant additions.

Also to the National Museum go the very lengthy and recently completed bibliography of Indo-Malayan entomology. This manuscript exists in the form of about 100,000 cards, each bearing not only one but many even two and three citations each. These are all in his own handwriting, as he had no typewriter of his own, and seldom borrowed one. His very extensive personal correspondence was carried on in the striking large hand in which he wrote.

In addition to the above manuscripts, there are several bibliographies of Philippine entomology, as well as other manuscripts, which are to go to the National Museum, along with his correspondence and personal papers.

To the College of Agriculture he gives his entire library, which is really only a small working collection of about 200 bound books and numerous pamphlets, including many current entomological journals. Other books and publications in large numbers he had already given to our College library from time to time. The College also receives his collection of shells (Mollusca) and his small herbarium and all botanical specimens, of which there are but few.

To Dr. Leopoldo B. Uichanco of this College he leaves all the field equipment, insect nets, and tools. The bottled specimens are also given to him.

Aside from the above, there is very little property. The furniture in the house is meagre and simple. His house and lot in Los Baños town are to be sold, and the proceeds, together with the small amount due him from the University on account of leave and retirement pay, are to be devoted to the collegiate and medical education of one to whom, though having no claim at all upon him, yet he felt deeply obligated.

Thus, long after he has ceased to head this unusual and outstanding educational experiment, and long after his own fingers have ceased to work over the insects of the day's or night's collections, will his old students, fellow workers, and beneficiaries continue to use and pass on to others the fruits of a life of outstanding unselfishness and remarkable intensity of activity.

ROBERT L. PENDLETON,
Of the Department of Agronomy.

RESEARCH AND PRACTICE

Reprinted from *Tropical Agriculture*, the official journal of the Imperial College of Tropical Agriculture, Trinidad, B. W. I.

In a recent issue of *The Times* there appeared an article on "Science and Farm Practice" which deserves the careful consideration of everyone engaged in tropical agricultural research and practice. It is emphasized that progress must inevitably be slow and the accruing results uncertain unless the two great forces in agriculture operate in harmony, and are mutually helpful. Agriculturists should appreciate the intricate nature of the work that engrosses and perplexes the scientists, but it is equally essential that the difficulties of putting their teaching into practice should be recognized by the men of science. Neither side has a monopoly of the serious obstacles to progress and if the best results are to be secured both must advance towards a common meeting place where their respective difficulties can be explained and discussed from the different aspects. It is recognized that the attitude of agriculturists towards science and those engaged in it has improved, and it is certain that the average agriculturist now manifests a greater respect for science than he did in the past. This improved relationship equally reflects a change in the bearing of scientists. As a result of increased experience each side has learned more fully the difficulties of the other.

The research worker needs the sympathy and indulgence of others besides the practical agriculturist. The enlightened agriculturist indeed appreciates the obscure and involved character of the problems engaging attention in the laboratory, and recognizes that results may not be forthcoming quickly. He knows that there is no short-cut to the solution of the problems which can be tackled on the land, and those to be investigated in the laboratory are known to be at least equally intricate and delicate. It is not, therefore, in this quarter that impatience is expressed with the rate of progress of work which scientists have on hand. On the contrary the agriculturist's main complaint lies in the hasty prononouncement of results. It has too frequently happened that results issued by centres of research have failed to justify themselves in field practice. Even one failure of this kind tends to shake confidence in science and it is of the utmost importance that in the future the greatest care should be exercised in eliminating as far as possible the issue of such imperfect results. The leading centres of research have been fully cognizant of the detrimental effect on scientific

investigation which results from the publication of incompleted studies and it is largely to this that the increased respect for agriculture is due.

The premature publication of results has not always been the fault of the investigators. The chief culprits, it is alleged, have been the authorities under whose auspices the investigations or field trials have been carried out. To them must be attributed a liberal share for the barrier which has separated scientific worker and practical agriculturist. Public bodies are usually impatient for results and do not invariably realise the time required to probe unsolved problems thoroughly and draw from the information revealed deductions that will yield definite and reliable results in the field. The enlightened planter usually has a sincere sympathy, born of his own experience, with the scientist hustled for results. *The Times* correspondent refers to one "discovery" whose failure in practice was estimated by scientists engaged in the same class of work to have thrown back the teaching of research work twenty years.

The clamor for immediate results has resulted in the neglect of some of the more fundamental problems of wide application, and, ultimately, of the greatest commercial importance, for which extended investigation is essential. It is for problems of this nature that institutions such as the College are best adapted, where necessary work could be continued over a long period by relays of research workers and problems could be approached simultaneously from various aspects and the results correlated and brought to bear upon the main issue. But for the performance of such work an adequate staff and ample land are essential. At present the demands upon the College in various capacities are increasing more rapidly than its resources. This issue is quite clear. With adequate financial backing the demands can be met; without it they cannot. Without an estate where investigations can be made and tried out on a commercial scale, and without staff necessary for this work some restriction in the activities of the institution can not be avoided. The more immediate functions are expanding so rapidly that the more fundamental research work, for which the constitution of the College is peculiarly well adapted, will, in all probability, suffer most. That such should prove the case would be most unfortunate. The remedy, however, lies not with the College but with others.

Dr. Erwin F. Smith, Dean of American plant pathologists, died on April 6, 1927, at the age of 73. Extracts from his address—"Some Thoughts on Old Age"—appeared in the PHILIPPINE AGRICULTURIST, March, 1927.

PERICYMA CRUEGERI (BUTLER): ITS LIFE HISTORY AND ECONOMIC IMPORTANCE (NOCTUIDAE, LEPIDOPTERA)[1]

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WITH TWO PLATES

Pericyma cruegeri (Butler) belongs to the family Noctuidae, subfamily Quadrifinae (Lepidoptera). The genus *Pericyma* is practically of world-wide distribution, having been reported from the Neartic, Neotropical, Ethiopian, Oriental, and Australian regions; but this particular species is very limited in its geographical range. It was first obtained from Australia by the collectors for the Godfrey Museum and was described by Butler (1896), as *Homoptera cruegeri*. W. B. Pryer found specimens of the same species in Sandakan, Borneo, and presented them to the United States National Museum (Butler, 1892). The Philippines is the third locality record for this species.[2]

The host plant is *Peltophorum inerme* (Roxb.) Naves (Leguminosae). This tree is indigenous in the Philippines, being found in the wild state along the seacoasts from Batangas to Negros, and on the coasts of Mindoro and Palawan. The tree is also a characteristic component of the flora of "Ceylon, through Malaya to northern Australia" (Merrill, 1912, p. 233). The distribution of the host, which is co-extensive with the pest, is a basis for the presumption that *Pericyma cruegeri* is a native of the Australian and the Malaysian regions.

As early as the middle of February, the caterpillars appear in great numbers and defoliate this common shade tree in Manila. The attack lasts until the middle of April, when suddenly the pest disappears, only to reappear at the same period the following year. These annual appearances are an intensely interesting phase in the study of this pest, as there are no marked climatic changes in the Philippines which might account for such a long period of rest (Uichanco, 1926). What causes it to remain dormant for about nine months and in what stage it passes from one year to the next have not been adequately studied.

In 1920 and 1921, two broods were observed. The first brood, which hatched about the middle of February, was not very large and only a few trees were affected. But about the middle of March, the second brood

[1] Received for publication April 19, 1927.

[2] The Philippine material was identified by W. Schaus, of the U. S. National Museum.

came out and the larvae attacked all trees which had not been defoliated by the first. In the meantime, the trees which had been affected by the first brood began to recover and develop new leaves which became fully formed by about the middle of April.

LIFE HISTORY AND HABITS

Eggs and egg laying. From five to eight days after emergence in captivity, the female moth begins to oviposit. The eggs are laid singly or in groups of two or three, usually near the tip of the leaflets. The eggs are loosely attached, so that probably many accidentally fall to the ground.

The egg (pl. I, fig. 1) is subspherical and has an equatorial diameter of 0.72 mm. and a length of 0.61 mm. from pole to pole. When freshly laid it is deep green and subconcolorous with the nether surface of the leaf. But as it approaches the end of the incubation period it fades to a light whitish-green color. The chorion bears thirty-two longitudinal ridges, which are arranged in pairs, the members of each pair coalescing just before reaching the polar regions.

Larvae. Under ordinary conditions, the egg hatches in from five to seven days after laying. Just before breaking out of the egg case, the larva, which measures about 4 mm. in length, is at first inactive. It is whitish green, thus resembling the color of the back part of the young shoots of *Peltophorum*. Each of the three thoracic legs is three-jointed and bears distally a pair of claws. In this instar only two abdominal prolegs are in evidence; these are located on the apparent eighth and ninth segments. The antennae are short and whitish green. The mandibles are prominent and pale yellow. Six black larval eyes are seen on either side of the head.

The larva molts four times. After ten to thirteen days it reaches a size of from 42 to 45 mm. (pl. I, fig. 2). The full-grown larva has prominent lateral markings composed of a continuous black line, a continuous thin white, a mixed white, a black and yellow, and a wide white line divided into segments by dark spots on the middle of each segment. These lateral markings are present both on the thoracic and the abdominal segments. The head is reddish yellow, and the body chalk-white on the dorsal side and dirty green on the ventral side. The thoracic legs are uniformly brown and the abdominal prolegs, now numbering three, are nearly of the same color, but conspicuously darker brown apically.

The larvae are restless and move about very rapidly, the smallest ones, about 4 mm. in length, being capable of covering a distance of 74 cm. a minute. If a caterpillar is shocked or otherwise disturbed, it suddenly drops and suspends itself by a tiny silk thread. It may either remain suspended in the air for a time or whirl about and jerk until it gets hold of an object or reaches the ground. The caterpillar has also the habit of moving down the trunk of the trees to the ground where it feels around only to come up again.

The caterpillar feeds by fastening itself on a midrib with its prolegs, grasping one side of the blade of a leaflet with its anterior legs and eating it with great rapidity. It starts along the edge, eating up a strip about 0.3 to 0.5 mm. in width without stopping until one side of the leaflet is consumed. It then commences at the other edge and repeats the process, until all or nearly all of the leaflet is devoured. This is the procedure when the food supply is scarce; when the supply is abundant, only the edges of the fresh leaf are eaten.

Prepupal and pupal stages. The full-grown caterpillar when ready to pupate remains inactive for a time; then it contracts, flexes the anterior part of its body ventrally, and starts forming a framework for its cocoon. The first step is spinning a few silk threads here and there around the place selected for pupation. The caterpillar then begins to work on this framework and the cocoon is reënforced from the inside by moving its head back and forth in all directions until the cocoon is completed[3]. Two or three days after it has started to spin, the larva molts for the last time, and changes into a pupa. The larva just before pupation is pale whitish green, flexed ventrally, thick, and greatly contracted (pl. I, fig. 3).

The female pupa averages 15 mm. in length and the male, 17 mm. although there is a great variation in the size (pl. I, fig. 3). The amount of food and, consequently, the size of the larva predetermines the relative size of the pupa. Owing to lack of food, the larval stage may be abridged and small pupae produced. That the size of the larvae is directly proportional to the amount of food available is seen from the fact that the pupae of the first brood, when the food supply was plentiful, were usually larger than those of the second brood when the food was scarce. The pupae are usually found between leaflets or between petioles of old leaves, but sometimes they may be found under the bark of trees, on scars left by old branches, or even between stones or wooden walls of houses. They may be either naked or surrounded by a thin coat of silk strands.

Adult. After a pupal period of from seven to eight days, the adult moth emerges. Emergence usually takes place between six and eight o'clock in the evening. The antennal cases first break away from the line on which they adhere to the wing pads and to the prothorax. The moth issues forth slowly, head first, then the legs, and finally the wings; it raises the cases of the legs and the proboscis to allow the escape of the wings and the body.

The adult, in common with all moths belonging to the family Noctuidae, is nocturnal in habit. In the day time, it is very inactive, staying in dark or dimly lighted places and flying only when disturbed. In the cages the moths gather in groups in dark corners and exhibit a decided negative

[3] It appears, at least under laboratory conditions, that cocoon formation is not a very essential prerequisite to proper pupation. A larva which has finished or partly finished spinning may be deprived of its cocoon and still be able to pupate properly.

light reaction. In captivity, they seem to do well on a diet of thin sugar solution. In this way the writer was able to keep them alive for as long as eight days.

ECONOMIC IMPORTANCE

The larva of *Pericyma cruegeri* is so voracious that at certain seasons it is a real menace to *Peltophorum inerme*. The writer has not, as yet, found any alternative host species. A tree attacked may become almost or entirely leafless five to ten days after the larvae hatch out (pl. II). Yet the attack, being sudden and of short duration, is normally not fatal to the plant. The latter easily recovers and begins to form new shoots a week after the old twigs, with empty pupal skins, fall to the ground. Were it not for the natural enemies of this caterpillar and for the apparent vigor of this tree, perhaps the effect would be more disastrous.

Besides being destructive, the larva is a nuisance to the public. When the caterpillars are very numerous, they often fall on people passing under the trees. The caterpillars even get under the clothing and cause a slight itchiness and redness of the skin.

NATURAL ENEMIES

Parasites. More than one-half of the pupae of the second brood collected from the trees around the campus of the University of the Philippines in Manila in 1921 were rigid and darker than the normal pupae. These, when dissected, were found to contain not the pupae of the moth but those of a Chalcis fly, *Chalcis albotibialis* Ashmead[4] (pl. I, fig. 5).

This chalcid is very abundant toward the end of March, during the time that the larvae of the second brood are beginning to pupate. They can be easily seen hovering around the trunk and large branches of the trees attacked by *Pericyma cruegeri*. It is at the critical prepupal stage that the parasite oviposits in the host. The moth's cocoon is thin, and is easily penetrable by the long ovipositor of the chalcid. Sometimes when the cocoon is thick the chalcid may spend ten to fifteen minutes in ovipositing. The parasitic larva, on hatching, finds itself in the midst of an abundant food supply, and developing proceeds very rapidly. During the first brood the writer found only a very few instances of parasitism; but with the second brood, about seventy per cent of the pupae were parasitized.

Other natural enemies. The fact that pupae are partly or wholly exposed makes them an easy prey to ants. More than one-fifth of the pupae collected from the shade trees around the campus of the University of the Philippines were found to contain nothing inside. They had a hole too

[4] This chalcid fly was identified by S. A. Rohwer, of the U. S. National Museum. [This parasite has likewise been frequently bred in Los Baños from pupae of the banana leaf roller, *Erionota thrax* Linn., Hesperiidae.—L. B. U.]

small to have permitted the escape of either the moth or the chalcid. Thus the writer is inclined to believe that the ants were responsible, to a limited degree at least, for the mortality of the pupae.

The common rice birds, *Munia jagori* Martens (family Ploceidae), and the common thickheads, *Hyloterpe philippinensis* Walden (family Laniidae), were seen picking up the caterpillars irrespective of size. They either ate them on the spot or flew away with them in their beaks.

As noted above, the caterpillars are extremely restless, especially those between 20 to 35 mm. in length. As a result, many fall to the ground where they are picked up and eaten by chickens.

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ILLUSTRATIONS

(Mr. Juan Fontenosa, of the Bureau of Forestry, helped in the preparation of photographs. The drawing of the egg, plate I, fig. 1, was made by Mr. Felix V. Santos, Department of Zoölogy, University of the Philippines.)

PLATE I

Fig. 1. Egg of *Pericyma cruegerei*. ×45.
Fig. 2. Larvae of *Pericyma cruegeri*, instars I, II, III, IV, and V. ×1.5.
Fig. 3. *Above:* Prepupa, ventrodextral view.
Below: Pupae, dorsolateral and ventrolateral views. ×2.
Fig. 4. Adults, dorsal view. *Above*, male; *below*, female. ×1.
Fig. 5. *Chalcis albotibialis*, dorsal, ventral and lateral views. ×4.

PLATE II

A *Peltophorum* tree, before and after the attack. (*a*) Taken March 10, 1927, before *Pericyma* larvae appeared. (*b*) The same plant, twenty-three days later, on Aptril 2, 1927, after the attack. The dots seen on the branches are leaflets encasing pupae.

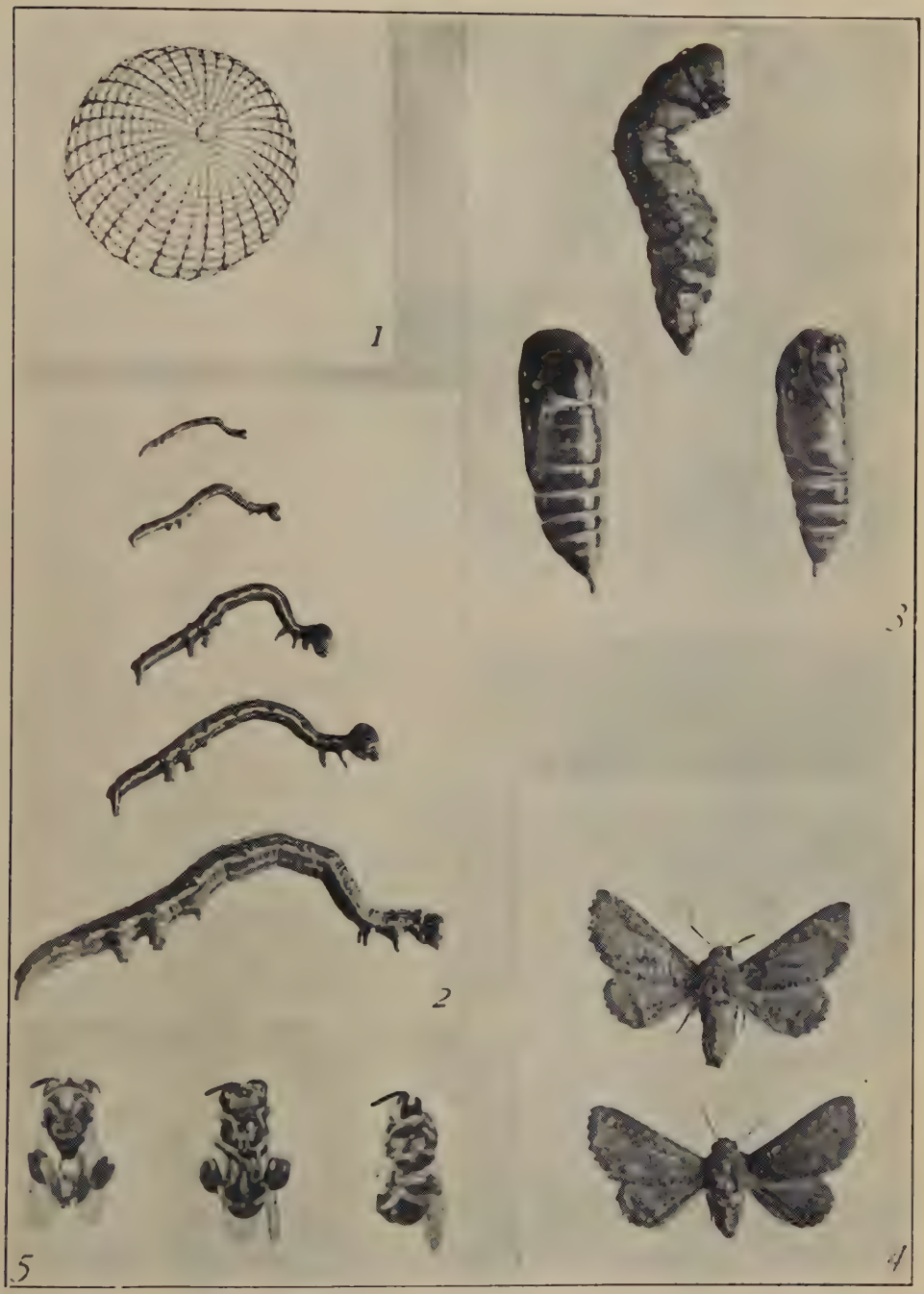

PLATE I

PLATE II

THE COST OF PRODUCING RICE, 1926–27[1]

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WITH TWO CHARTS

INTRODUCTION

The knowledge of the cost of production is necessary in the successful management of any business. With reference to farming, Adams (1921) writes: "Knowledge of costs means fewer mistakes in judgment and better earning ability". Such studies are of principal interest to farmers because through understanding their cost of production they can determine the price that should be placed on their products, or the margin of profit that is obtained from the current price in the market for such products. This is of help in reorganizing the farm for better farm income and profit in the future. Farmers obtain a knowledge of the different elements of cost which they can use as a basis in studying the ways of making the farm pay more by reducing cost and increasing returns. Furthermore, facts revealed by cost studies are of value in price-setting, tariff-making, and other legislative and administrative measures.

Object of the present work

The aim in this study is to throw some light on the cost of producing rice by determining the individual farm costs as found in the most important rice region of the Islands. For a cost-inquiry study to fulfill all the uses enumerated elsewhere requires a personnel and outlay of money and time extensive enough to study comprehensively all the producing regions, and to take enough records to make the result a "reasonable index of existing conditions". Such a survey was beyond accomplishment by the writer under present conditions. However, the value of the survey of a limited area remains the same for the districts affected, especially when they are representative ones, and, in addition, they may serve as an index of conditions in other parts of the Islands.

That there is no such a thing as definite and specific cost figure has already been demonstrated. Costs differ widely on different farms, and even on the same farm yearly variations have been noted. The study here presented aims to show, so far as the survey covers, this wide range of cost. Material and labor requirements are also given.

[1] Experiment Station contribution No. 456. Received for publication June 20, 1927.

SCOPE AND METHOD OF STUDY

Time and place of survey

This study was carried out in three towns located in different parts of Pangasinan; namely, San Carlos, Mangaldan, and Balungao; and in Peñaranda and San José in Nueva Ecija. From these five towns data from 234 farms were obtained. These two provinces are the two premier rice producing provinces of the Philippines. The Bureau of Commerce and Industry (1926) shows that for the year ending June 30, 1924, they produced 12,779,000 cavans of palay which comprised 31 per cent of the total rice raised in the Islands. And of the 1,904,125 sacks of clean rice (equivalent to 3,910,254 cavans of palay) shipped to Manila over the Manila Railway from Central Luzon in 1925, they contributed about 73 per cent.

The investigation was carried out during vacation days of the writer in the summer of 1927, hence the data collected refer to the rice crop planted in 1926, but the rest of the farm operations, especially threshing, extends to the early months of 1927.

Method of collecting the data

The method used in collecting the data was the so-called "survey" method which consists of making personal visits to the farmers in the districts studied. Farmers keep no records so figures were from their estimates. Their estimates, however, may be given full face value as they have been doing the same thing for a number of years, and the simplicity of operations on the farm makes it possible for the figures to be held perfectly well in memory. To facilitate the taking and recording of information desired from the farmers, the writer took with him copies of prepared questions. Several landlords were also questioned as to land values and prices of product after harvest.

Elements of cost and method of computation

The different elements of cost may be given as follows: land cost, building cost, farm implement cost, cost of man (farmer's and outside) and animal labor, cost of seeds, and miscellaneous costs.

Land cost. The use-cost of land, or land rent, was made up of interest on sale value of land, and taxes. The rate of interest was ten per cent. Ten per cent is a conservative charge in these rice growing districts as elsewhere in Philippine rural regions. The same rate was used whenever interest was to be charged.

Labor cost. Man labor on the farm was supplied in two forms. One was by the farmer himself, as in seed bed and land preparation; another was by outside labor which was paid either on daily basis, or on the extent of the work finished, or on share. Co-operative labor, since it was repaid by the farmer with labor, was considered borne by him. The cost of the farmer's labor was calculated by using the actual daily rate at which such

labor could be employed in the locality. To this rate was added the cost of food for such laborers. The contract-labor cost included the amount of cash paid, and food and other expenses. When a certain operation was performed on share, to keep the total production intact, the laborer's share was not subtracted from the production; it was evaluated at the price that the share would receive at the time and this amount was included in the list of costs.

Animal labor. The cost of animal labor consisted of interest on value of animals used plus depreciation. These two items make up the total cost of animal labor. To determine the daily rate of animal labor, the total cost was divided by the total number of days of work.

Building cost. The building cost included interest on investment and depreciation of those buildings which were directly used in farming, such as storehouses, or *camaligs* and sheds in the field for use during the working season. Dwellings were excluded both in cost and in the list of farm investment.

Cost of implement use. This consisted of interest on the value and yearly depreciation of plows, harrows, sleds, and harvesting implements.

Cost of seed. The cost of seed was computed on the basis of price at which they could be sold during the threshing season.

Miscellaneous cost. This was made up of amount paid for water or cost of labor used in watering the field, and interest on cash expenditures based on ten per cent from the time the expense was incurred up to threshing period. Such expenses were the amounts paid for food and for various operations. Pre-planting expenses were charged for a period of eight months, while planting expenses were charged for six months.

The computation of cost of production was not based on the basis of either the landlord or the tenant, although the majority of farms visited was under the share system of tenancy. Cost was computed on the basis of owner-operator, and therefore in case of share tenancies it was taken for granted that the two parties were on partnership basis, which is claimed by Hester, et al (1924) to be on an equitable and just foundation, in referring to the typical contract as applied to 70 per cent of tenancies covered in their survey.

FARM ORGANIZATION AND PRACTICE

In Pangasinan

Several differences in farm organization and in farm practice in the different districts surveyed were noted. In the west half of Pangasinan as represented by San Carlos and Mangaldan, other crops, such as tobacco, corn, and garden crops are rotated with rice in part of the area devoted to this crop. The farmers also grow coconuts. A little east of this region, around Rosales, the principal crop rotated with rice is mungo (*Phaseolus aureus* Roxb.). But from Balungao east to San José and south of Nueva Ecija, practically no crops are grown on the field after rice is harvested.

The places surveyed do not have irrigation systems except in San José where several farms surveyed can be irrigated.

The survey dealt with the transplanting method, the general method of growing rice in these places. Numerous similarities and differences were noted in farm practice. In Pangasinan, rice farmers use bearded varieties and in Nueva Ecija, the non-bearded. In Pangasinan the bearded varieties used are Castaño, Binalolaqui, and Sinampurin in San Carlos; Contenido, Pinili, and Nalmuan in Mangaldan; and in Balungao, the popular varieties are Pinirencesa, Itang, and Piñas. Seeding is done during the months of May and June, planting principally in July and August, and harvesting generally in the months of November and December. The systems of seeding usually followed are the *capitan,* or harrowed in, and the *bakal,* or dropped in. Broadcast seeding is also done. The seed bed is plowed and harrowed from three to five times before seeding.

The field for transplanting is usually prepared during the months of June and July. It takes from one to two plowings and one to three harrowings to make the field ready for transplanting. Man labor alone is rated at from fifty centavos to one peso a day. At the age of about a month, depending upon the variety used, seedlings are pulled up for transplanting. Women usually do this work while men do the transplanting. Women pullers are paid about fifty centavos a day or by contract, from thirty to sixty centavos a hundred bundles of pulled-up seedlings. Men transplanters are paid from fifty to seventy centavos a day, often with food. Harvesting is done during the months of November, December, and as late as January. Harvesting is done principally on shares; one-fifth in San Carlos and Mangaldan, and from one-sixth to one-ninth in Balungao. Co-operative harvesting is also as common as on shares in Balungao. The heads of palay are cut off with an *atab, gamlang,* or *rakem,* which is a sickle or knife attached to a piece of wood for a handle. The harvested heads are tied in small bundles which are then tied into larger bundles called *capongo, manojo,* or *catanay.* After drying, these bundles are stored in *camaligs,* or storehouses which are built near the dwellings of many farmers. The bundle is the small unit of production and unthreshed rice is sold in this form.

In Nueva Ecija

In Nueva Ecija, non-bearded varieties are generally used except in places along the border of Pangasinan. In San José for example, bearded varieties are used to a limited extent; the most widely used varieties are the Saigon, Magkompol, and Inachupal. The most popular varieties in Peñaranda are the Macan-bocaue, Macan-aga, and Macan-putat. Seeding is done from the latter part of May up to June; planting, generally in the months of July and August; and harvesting, principally in November and December. The system of seeding in Peñaranda is the broadcast, or *palusad* while in San José, in addition, the *bakal* is used.

Fields are usually given one plowing and two to three harrowings. The harrows used are usually made of iron, but few iron plows are used. Man labor alone is generally rated at one peso a day. The general practice in Nueva Ecija is that seedlings are pulled up by men and the transplanting is done by women, a reversal of the practice in Pangasinan. However, in some places, as in San José, men also transplant to a limited extent. Pullers are paid from fifty centavos to sometimes as high as one peso a day; a transplanter from eighty centavos to one peso a day, or by contract, as in Peñaranda, from ten to twelve pesos a cavan of seed planted. In San José, women transplanters are paid fifty and sixty centavos a day and men one peso. The harvesting implement is usually the *linkao* in Peñaranda, while in San José the *palot* or *pangapas* is more generally used. Harvesting is either by co-operative system or by contract or daily wages of from fifty and sixty even up to eighty centavos a day. After harvest the bundles are allowed to dry for a few days and then are shocked and stacked. After several weeks in the stack the palay is threshed either by tractor-drawn thresher or by men and animals on shares ranging from six to ten per cent. The unit of production is the cavan. No storehouse, as in Pangasinan, is used; instead, farmers have buildings for shelter while working in the field.

Farm investment

In order to give an idea of the nature of rice farming with respect to investment, equipment, size and value of farms, table 1 was prepared.

A study of table 1 will show that the average farm area of the districts surveyed is less than two hectares, the average for all being 1.69 hectares; the average value from ₱263.76, as found in San Carlos (lowest), to ₱561.37 in San José (highest), or a general average of ₱449.51. Thus in value of land investment the average farm is less than a thousand pesos, the average for all farms being ₱764.92. In implements, each farm has slightly more than one plow and one harrow, the average per farm for all towns being 1.05. Several farms carry more than one work animal, the average figure being 1.23. The average price of animals ranges from less than ₱100 to about ₱130 or an average for all farms of ₱109.05, making an investment in animals per farm of ₱132.60. Only slightly more than one-half of the farms (or 0.55 in exact figures) have buildings as part of the farm investment, at an average cost of ₱16.74. Buildings on farms in Pangasinan are valued much higher than this average but the average is reduced because of low cost of farm buildings in Nueva Ecija where the average cost is but six pesos. The total investment per farm ranges from an average of ₱511.14, as found in San Carlos, to ₱1,214.99 in San José. This marked contrast is due to the marked difference in price of land. The average total investment per farm of all farms surveyed is ₱923.37. Of this amount, 82.84 per cent is in land, 14.36 per cent in animals, and the rest in equipment (1.70 per cent) and buildings (1.10 per cent).

COST OF PRODUCING RICE

Summary of costs

The cost figure has been assembled under five headings; namely, cost of man labor, animal labor, seed, and threshing, cost of the use of land, and other costs. The last named item includes use of buildings, use of equipment, and interest on operating expenses, and on some farms in San José the water charges. Dividing the total cost in each town by the number of hectares gives the cost per hectare. The cost of each unit of product was obtained by dividing the total of all costs by the total production. In table 2 are summarized the different items of cost per unit of product and per hectare of land as found in Pangasinan and Nueva Ecija. The unit of production, it will be observed, is not the same in the two provinces. The *capongo*, a bundle of rice panicles, is used in Pangasinan, while in Nueva Ecija the cavan is used. Inasmuch as the *capongo* is quite variable in size and more so in weight and the amount of clean rice that can be obtained from it, no attempt was made to make a comparison of production and cost between the two regions.

Table 2 shows the average cost a hectare of producing rice in Pangasinan and in Nueva Ecija. In Pangasinan the cost per hectare is from ₱98.50, the average in San Carlos, to ₱125.44, the average for Mangaldan; with a general average for the region of ₱110.56. The production to the hectare ranges from 103.08 *capongos* (for Mangaldan) to 140.09 *capongos*, the average for Balungao. This gives an average cost per *capongo* of ₱0.77 (Balungao) to ₱1.22, for Mangaldan, or an average for the entire region of ₱0.94. The cost of land and labor cost are the two important items in this cost, land alone constituting 40.86 per cent, and labor cost, 51.75 per cent (41.31 for man and 10.44 for animal). Seed constitutes 2.33 per cent and other costs, 5.06 per cent.

In Nueva Ecija, where the cost per hectare is greater than in Pangasinan because of higher land and labor cost, it may be seen that the average cost of producing rice per hectare is from ₱128.14 (in Peñaranda) to ₱152.55 (in San José) or an average of ₱140.35 for the entire region. The average yield is from 36.74 cavans for Peñaranda to 58.27 cavans for San José, or an average of 47.50 cavans. A great difference in yield in addition to other factors resulted in a great variation in cost per unit of product, this being ₱3.49 in Peñaranda and ₱2.62 a cavan in San José, or an average of ₱3.05. It may be stated at this point that San José is one of the highest yielding towns in Nueva Ecija, while Peñaranda is in the list of towns with very low yield. Of the average cost, 38.39 per cent is for land use, 38.60 for man labor, 8.66 for animal labor, 7.71 for cost of threshing, 1.77 for seed, and 4.87 per cent for other costs.

Variation in cost per hectare and per unit of product

As 40.86 per cent of the cost is due to cost of use of land, variation in cost per hectare is caused principally by the cost of use of land (see "Pangasinan" tables 1 and 2). Examination of tables will show that there is little variation in the amount of labor and labor rates. This is illustrated in Nueva Ecija where the labor cost is almost the same (table 3) but the total cost per hectare differs widely (table 2).

Variation in cost per unit of product is influenced by the cost per hectare and yield. The amount of yield, which is highly variable, is a factor greatly affecting the cost per unit of product. In Pangasinan (table 2) San Carlos showed a higher cost per *capongo* than Balungao although the latter had higher cost per hectare, but it had higher production. Of course, as with Mangaldan, a very high cost and only slight increase in yield may produce an unfavorable result. Data on Nueva Ecija (table 2) clearly show the effect of yield on cost per unit of product. A much higher cost per hectare in San José produced a low cost per cavan because of high yield. This relation should be taken into account by farmers and farm managers in attempting to get better farm incomes.

Labor cost

It may be seen that labor cost (man and animal) constitutes about half of the costs. Table 3 was prepared to show what part of this cost is man labor, what part is animal labor, and which operations on the farm consume the greatest amount of labor.

An examination of table 3 shows that the labor cost in all places surveyed in Pangasinan is ₱57.20 a hectare on the average. Of this amount, 79.84 per cent was the cost of man labor and only 20.16 per cent was animal labor. This means that each *capongo* which cost an average of ₱0.94 required ₱0.49 of man and animal labor. The operations were divided into the following headings: seed bed, land preparation, pulling up seedlings, transplanting, harvesting, and shocking and stacking. Of the labor cost, 35.80 per cent was for harvesting, 31.66 per cent for land preparation, 14.72 per cent for transplanting, and 7.26 per cent for seed bed.

In the two places in Nueva Ecija (table 3) the labor cost per hectare was nearly the same, the average being ₱66.33, or ₱1.47 per cavan of product. Of this cost, 81.68 per cent was man labor, and 18.32 per cent, animal labor.

Of the different field operations, land preparation used 36.77 per cent, transplanting, 20.23 per cent, and harvesting, 18.72 per cent. It will be observed that harvesting is the largest individual cost in Pangasinan, while in Nueva Ecija it is the second largest, because the method of harvesting by the *atab* in Pangasinan consumes much time.

Range in cost per unit of product

To show the range in cost per unit of product the two charts (charts 1 and 2) were prepared. The first chart is for farms in Pangasinan, and the second for Nueva Ecija, where a comparison of a highly productive and non-productive district is shown.

The minimum cost per *capongo* in Pangasinan is ₱0.42 as obtained from two farms and the highest is ₱2.05 (obtained from three farms). The average cost for all the farms surveyed is ₱0.94. From chart 1 it may be seen that 52 per cent of the growers in Pangasinan produced rice at a cost of ₱1.00 or less. Only six farms, or about 4.5 per cent, produced at a cost above ₱1.80 per *capongo*. Seventy-six per cent of all the farms produced rice at a cost of ₱1.50 or less a *capongo*.

In Peñaranda, Nueva Ecija, the average cost a cavan was ₱3.49, the lowest cost figure being ₱2.60 and the highest, ₱7.59. Only 24 per cent

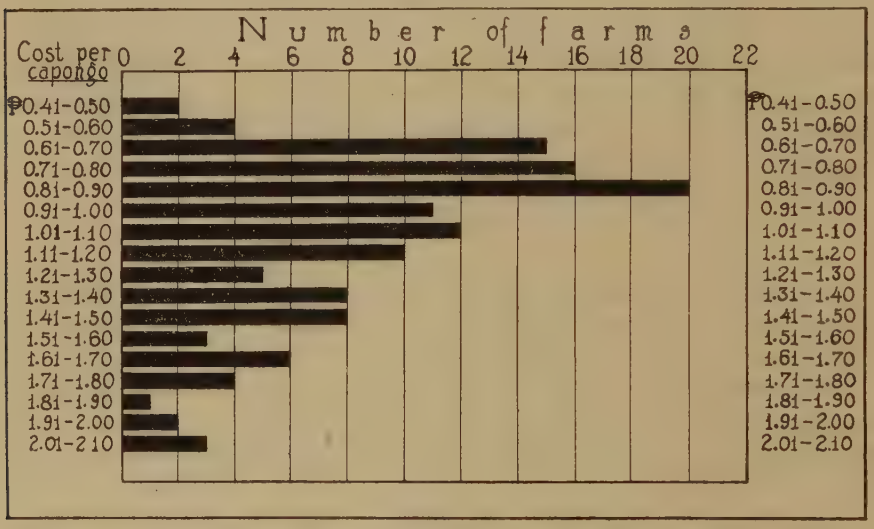

Chart 1.—Showing the range in cost per *capongo* of rice in Pangasinan, 1926–1927.

of the farms produced at a cost of ₱3.00 or less per cavan, and on 70 per cent the cost was ₱3.90 or below. Nine per cent produced at a cost above ₱5.00 a cavan. In San José, the average cost was ₱2.62 a cavan, the lowest being ₱2.05 and the highest, ₱4.71. Seventy-four per cent of the farms produced at the cost of ₱2.80 or less, on only four per cent was the cost ₱4.00 and above.

Return and margin above cost

Rice in San Carlos brought the farmers around 70 to 80 centavos a *capongo* during January and one peso in March. The starting point in other places surveyed in Pangasinan was around 80 centavos and one peso, staying at one-peso mark till the end of March. Previous prices reached as high as two pesos during September and October.

At 80 centavos a *capongo* (January price), only about 29 per cent of the farmers would have received their cost of production, with the majority receiving a profit of about 10 centavos. At one peso (March price) only about 52 per cent would have received amounts equal to their cost of production, with the majority receiving profit from 10 to 30 centavos a *capongo*. If the price of the 1926–27 crop ever reaches the two-peso point, then only about two per cent will fail to receive sufficient returns to compensate them for their cost of production.

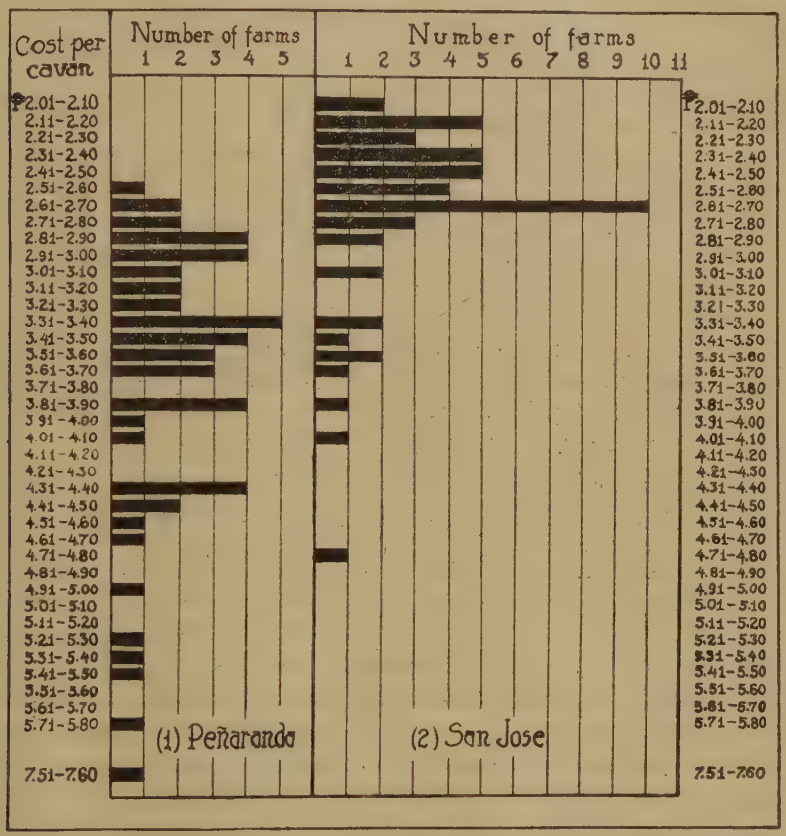

Chart 2.—Showing the range in cost per cavan of rice in (1) Peñaranda, and (2) San José, Nueva Ecija, 1926–1927.

The rice farmers in Nueva Ecija got around ₱3 a cavan as minimum price for their product, the price depending upon the distance of the farm from Cabanatuan. In Peñaranda the minimum obtained was ₱3.00, and in San José, ₱2.80. The 1927 price at Cabanatuan started around ₱3.30 to ₱3.50, depending upon the quality of the product. There was very little fluctuation in price for the first few months as the average for the period from January till end of May was from ₱3.30 to ₱3.50 a cavan.

At ₱2.80 a cavan, 74 per cent of the San José farmers would have received their cost of production, many with a margin above cost of from ten to thirty centavos. At ₱3.30, the price at end of May, only 18 per cent of the farms would have received less than the cost of production. In Peñaranda, at ₱3.00 but 24 per cent would have received cost of production. At ₱3.30, 35 per cent would have sold at cost.

Experience of farmers concerning price shows that during the months of August and September prices rise to ₱4.00 and even higher. The average price for July, August, and September, 1926, at Cabanatuan was from ₱4.42 to ₱4.53, depending upon quality[2]. As 1926–27 rice production is greater than that of 1925-26, it is not expected that the price will reach the high level of the previous year. A comparison of prices from January to May, 1926, and of 1927 for the same period shows a difference of about seventy centavos per cavan. Mr. Hill (1927) estimates that the extreme rice peak for palay this year will not go over ₱3.75. At this price, 34 per cent of farmers in Peñaranda will not receive amounts sufficient to cover their cost of production, many of them losing one peso or more per cavan. In San José, but six per cent will have sold below cost.

This scale of prices shows what the farmers would get at different times of the year and the proportion of farmers that could not receive even cost at different prices. However, it is common knowledge that a great proportion of the rice crop raised in these regions is sold during the first months of the year,—from January to May. It may seem foolish for these farmers to sell their rice when the price is low and to buy it back later at nearly twice the price, but circumstances force them to do so. They have to meet obligations with money lenders who loan money payable after threshing of the crop,—a most unfavorable time for the farmers. In many cases, however, these farmers are to blame. They seem to take for granted that anything left over is a gain which they may use for present luxuries and they feel themselves in duty bound to indulge in a little pleasure and laziness, instead of saving for future times of stress.

The rice farmers sold a major part of their product at about ₱1.00 a *capongo* (summer price) in Pangasinan, and ₱3.30 a cavan in Nueva Ecija. Which means that of this major portion of the crop only 52 per cent is sold in Pangasinan at least at cost, a large part receiving a profit of from ten to thirty centavos a *capongo*. Forty-eight per cent of the crop sold at this period received from ten to fifty centavos less than the cost and as much as ₱1.00 in certain cases. In Peñaranda, Nueva Ecija, but 35 per cent of this part of the crop received at least cost, many sold with profit of from ten to forty centavos a cavan. The other 65 per cent received from ten centavos to one peso or more less than the cost of production. In San José, a fertile district, but 18 per cent of the part sold at this period

[2] Weekly market report of the Bureau of Commerce and Industry.

received less than cost, principally from ten to fifty centavos a cavan. A great many of the other 82 per cent, however, received profits of from forty to one peso a cavan.

BASIC REQUIREMENT PER HECTARE

A consideration of the basic factors of production—material and labor requirement—is essential, inasmuch as these factors do not vary greatly from year to year. Values may change from year to year, and to present cost on a money basis alone is inadequate since the result can not be compared with later studies when values have already changed. A knowledge of the basic requirement will enable one to get a close approximation of the total cost per hectare at any given time after applying cost of material and labor rates. Consequently, a close estimate of cost per unit of product could be obtained.

In table 4, the seed required and the number of days of man and animal labor needed per hectare in each of the different farm operations and percentage of each are given. Farm operations were divided into: seed bed, plowing, harrowing, pulling up seedlings, transplanting, harvesting, and shocking and stacking.

Table 4 shows that in Pangasinan an average of 2.54 *capongos* of seed is required per hectare. An average of 56.91 days of man labor and 14.96 days of animal labor is needed to produce a hectare of rice, or about 0.48 days of man labor and 0.13 days of animal labor, per *capongo* of product. Of the amount of man labor required, the greater part is spent in harvesting (47.32 per cent), transplanting (16.92 per cent), and land preparation (19.75 per cent). Of the animal labor, the greater part is spent in plowing (52.68 per cent), harrowing (22.46 per cent), and seed bed preparation (16.04 per cent).

In table 4 are also shown the basic requirements for a hectare of rice in Nueva Ecija. An average of 20.05 gantas of palay is needed per hectare, and 51.32 days of man labor and 17.07 days of animal labor, or 1.08 and 0.36 days of man and animal labor, respectively, for each cavan of product. Of the days of man labor, harvesting consumed 27.08 per cent; transplanting, 23.62 per cent; and land preparation, 23.86 per cent. Of the animal labor days, plowing consumed 42.18 per cent; harrowing, 29.52 per cent; shocking and stacking, 18.22 per cent; and seed bed, 10.08 per cent.

A comparison of the two provinces will show that the Pangasinan farmer used nearly six days more of man labor but two days less of animal labor than the farmer in Nueva Ecija. This is because harvesting in Pangasinan with the use of the *atab* is a slow process. The percentage of man labor in different operations will show the striking difference. The Nueva Ecija farmer used two days more of animal labor partly because of stacking.

SUMMARY OF CONCLUSIONS

Within the limit of the survey, the following conclusions may be drawn.

1. The average rice farm in Pangasinan and Nueva Ecija has an average area of 1.69 hectares, valued at an average of ₱449.51 a hectare. The total of average investment is ₱923.37, 82.84 per cent of which is in land, 14.36 per cent in animals, and the remainder in buildings (1.10 per cent) and equipment (1.70 per cent).

2. The 1926-27 rice crop cost the Pangasinan farmer an average of ₱0.94 a *capongo*, 51.75 per cent of which was the cost of man and animal labor, and 40.86 per cent, the cost of use of land.

3. It cost the Nueva Ecija farmer an average of ₱3.05 a cavan, 47.26 per cent of which was the cost of man and animal labor, and 38.39 per cent the cost of use of land.

4. Of man and animal labor cost (₱57.20 a hectare) in Pangasinan (which was 51.75 per cent of all costs), an average of 79.84 per cent was man labor and 20.16 per cent, animal labor. Harvesting required a greater cost (35.80 per cent) than land preparation (31.66 per cent), or transplanting (14.72 per cent).

5. In Nueva Ecija, of the ₱66.33 labor cost per hectare (which was 47.26 per cent of total cost) 81.68 per cent was the cost of man labor and 18.32 per cent, animal labor. Land preparation consumed the greatest individual operation (36.77 per cent); harvesting, 18.72 per cent; transplanting, 20.23 per cent; and shocking and stacking, 14.16 per cent.

6. The cost per *capongo* in Pangasinan varied from ₱0.42 to ₱2.05. Fifty-two per cent of the growers in Pangasinan produced rice at a cost of ₱1.00 or less; 76 per cent at ₱1.50 or less, and only 4.5 per cent at a cost above ₱1.80.

7. The cost of a cavan of rice in Nueva Ecija ranged from ₱2.05 (found in San José) to ₱7.59 (found in Peñaranda). In Peñaranda only 24 per cent of the farms produced at a cost of ₱3.00 or below, 70 per cent at ₱3.90 or less, 28 per cent at above ₱4.00, and 9 per cent at above ₱5.00. In San José, 74 per cent produced at ₱2.80 or less, and only 4 per cent at above ₱4.00.

8. At the price of ₱0.80 a *capongo* (January price), only about 29 per cent of farmers would have received their cost of production, the majority receiving a profit of ten centavos a *capongo*. At ₱1.00 (March price) 52 per cent would have received their cost of production. At ₱2.00 only 2 per cent would have received less than cost of production.

9. At the price of ₱2.80 a cavan, 74 per cent of the San José farmers would have received cost of production, the majority of them receiving a profit of from ten to thirty centavos. At ₱3.00 but 24 per cent could have received cost of production in Peñaranda, this percentage being increased to 35 per cent at ₱3.30 (March price). In San José, at this price, the per-

centage would be increased to 82 per cent. At ₱3.75, only six per cent would not have received cost of production in San José, while in Peñaranda the percentage would be 34 per cent.

10. As a major portion of the rice produced was sold during summer, then for this part of the production in 1927 about ₱1.00 a *capongo* was received in Pangasinan, and ₱3.30 a cavan in Nueva Ecija. At these prices only 52 per cent of the portion sold in Pangasinan and in Nueva Ecija, 35 per cent in Peñaranda and 82 per cent in San José, was sold at least at cost; many of the producers, however, received a profit of from ten centavos up. On the other hand as much as 48 per cent of this part of the crop in Pangasinan was sold at fifty centavos or more below the cost of production. In Peñaranda, Nueva Ecija, 65 per cent was sold at a loss of from ₱0.10 to ₱1.00 or more a cavan, while in San José only 18 per cent was sold at less than cost.

11. To grow a hectare of rice in Pangasinan requires an average of 2.54 *capongos* of seed, and 56.91 days of man labor and 14.96 days of animal labor. Man labor is mostly spent in harvesting (47.32 per cent), land preparation (19.75 per cent), and transplanting (16.92 per cent). Of days of animal labor, plowing consumed 52.68 per cent; harrowing, 22.46 per cent; and seed bed, 16.04 per cent.

12. A hectare of land in Nueva Ecija requires 20.05 *gantas* of palay seed, 51.32 days of man labor, and 17.07 days of animal labor. Man labor is principally required in harvesting(27.08 per cent), land preparation (23. 86 per cent), and transplanting (23.62 per cent). Of days of animal labor, an average of 42.18 per cent is spent in plowing the field, 29.52 per cent in harrowing, 18.22 per cent in shocking and stacking, and 10.08 per cent in seed bed preparation.

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TABLE 1

Showing nature and value of farm investment on rice farms in Pangasinan and Nueva Ecija, 1926–1927

	PANGASINAN			NUEVA ECIJA		AVERAGE	PERCENTAGE OF INVESTMENT
	San Carlos	Mangaldan	Balungao	Peñaranda	San José		
Number of farms	34	46	50	54	50		
Total area (hectares)	50.33	62.60	90.53	104.71	92.72		
Total cost (pesos)	13,275.00	32,924.98	42,900.00	44,246.99	52,050.00		
Av. cost per hectare	263.76	525.96	473.88	422.57	561.37	449.51	
Av. area per farm	1.48	1.37	1.81	1.94	1.85	1.69	
Av. cost per farm	390.44	715.76	858.00	819.39	1,041.00	764.92	82.84
Number of animals	37	53	81	60	59		
Total cost (pesos)	3,455.00	5,490.00	7,370.00	7,795.00	7,514.00		
Av. cost per animal	93.38	103.58	90.99	129.92	127.36	109.05	
Av. animal per farm	1.09	1.15	1.62	1.11	1.18	1.23	
Av. cost per farm	101.62	119.35	147.40	144.35	150.28	132.60	14.36
Number of plows	34	46	62	55	50		
Total cost (pesos)	221.50	291.00	587.50	448.00	518.80		
Av. cost per plow	6.51	6.33	9.48	8.15	10.38	8.17	
Av. plow per farm	1.00	1.00	1.24	1.02	1.00	1.05	
Av. cost per farm	6.51	6.33	11.75	8.30	10.38	8.65	0.94
Number of harrows	34	46	65	54	47		
Total cost (pesos)	43.50	58.50	58.50	419.50	384.50		
Av. cost per harrow	1.28	1.27	0.90	7.76	8.18	3.88	
Av. harrow per farm	1.00	1.00	1.30	1.00	0.94	1.05	
Av. cost per farm	1.28	1.27	1.17	7.76	7.69	3.83	0.41
Sled and other equipment cost	70.70	134.85	127.70	249.20	189.10		
Av. cost per farm	2.08	2.93	2.55	4.61	3.78	3.19	0.35
Number of buildings	15	33	36	23	22		
Total cost (pesos)	313.00	744.25	1,012.00	183.00	93.00		
Av. cost per building	20.87	22.55	28.11	7.96	4.23	16.74	
Av. building per farm	0.44	0.72	0.72	0.43	0.44	0.55	
Av. cost per farm	9.21	16.18	20.24	3.39	1.86	10.18	1.10
Av. investment per farm (pesos)	511.14	861.82	1,041.11	987.80	1,214.99	923.37	100.00

TABLE 2

Summary of cost of producing rice in Pangasinan and Nueva Ecija, 1926–1927

	PANGASINAN			AV. PER HECTARE		NUEVA ECIJA		AV. PER HECTARE	
	San Carlos	Mangaldan	Balungao	Cost	Percentage of cost	Peñaranda	San José	Cost	Percentage of cost
Number of farms	34	46	50			54	50		
Total area (hectares)	50.33	62.60	90.53			104.71	92.75		
Total production (*capongo* or cavan)[a]	5,820.00	6,453.00	12,682.00			3,847.00	5,405.00		
Av. yield per hectare	115.64	103.08	140.09	119.60		36.74	58.27	47.50	
Man labor cost:[b]	₱2,608.09	₱2,889.45	₱3,533.85	₱45.67	41.31	₱5,773.46	₱4,936.45	₱54.18	38.60
Seed bed	73.55	202.20	176.05	2.21		248.46	183.20	2.18	
Land preparation	412.05	833.40	644.15	9.54		1,566.30	1,564.80	15.92	
Pulling up seedlings	177.60	202.40	154.60	2.82		438.30	234.65	3.36	
Transplanting	591.00	428.40	603.50	8.42		1,508.80	1,152.30	13.42	
Harvesting	1,241.50	1,085.30	1,760.10	20.48		1,437.90	1,031.50	12.43	
Shocking and stacking	112.39	137.73	195.45	2.20		573.70	770.00	6.87	
Animal labor cost	526.37	782.52	1,053.50	11.54	10.44	1,153.14	1,232.44	12.15	8.66
Use of land	1,448.66	3,581.91	4,483.50	45.18	40.86	4,808.99	5,735.83	53.88	38.39
Threshing cost						923.28	1,189.10	10.82	7.71
Seed cost	118.25	207.00	190.25	2.58	2.33	263.82	227.25	2.49	1.77
Other costs:[b]	256.12	391.83	490.72	5.59	5.06	494.67	828.40	6.83	4.87
Use of implements	145.21	198.60	247.96	2.93	2.65	297.33	314.16	3.12	2.21
Use of buildings	52.67	135.29	171.96	1.70	1.54	55.94	41.39	0.49	0.35
Miscellaneous	58.24	57.94	70.80	0.96	0.87	141.40	472.85	3.22	2.31
Total cost	4,957.49	7,852.71	9,751.82	110.56	100.00	13,417.36	14,149.47	140.35	100.00
Av. cost per hectare	98.50	125.44	107.72	110.56		128.14	152.55	140.35	
Av. cost per *capongo* or cavan[a]	0.85	1.22	0.77	0.94		3.49	2.62	3.055	

[a] *Capongo* is the unit of measure used in Pangasinan.
Cavan is the unit used in Nueva Ecija.
This cost is total of individual costs listed under it.

TABLE 3

Summary of labor costs involved in different farm operations in Pangasinan and Nueva Ecija, 1926-1927

	PANGASINAN			AV. PER HECTARE		NUEVA ECIJA		AV. PER HECTARE	
	San Carlos	Mangaldan	Balungao	Cost	Percentage of cost	Peñaranda	San José	Cost	Percentage of cost
	pesos	*pesos*	*pesos*	*pesos*		*pesos*	*pesos*	*pesos*	
Seed bed:[b]	141.12	342.96	378.03	4.15	7.26	378.35	288.12	3.35	5.05
Man labor	73.55	202.20	176.05	2.21	3.86	248.46	183.20	2.17	3.27
Animal labor	67.57	140.76	201.98	1.94	3.40	129.89	104.92	1.18	1.78
Land preparation:[b]	816.78	1,424.45	1,388.90	18.11	31.66	2,366.87	2,427.14	24.39	36.77
Man labor	412.05	833.40	644.15	9.54	16.68	1,566.30	1,564.80	15.92	24.00
Animal labor	404.73	591.05	744.75	8.57	14.98	800.57	862.34	8.47	12.77
Pulling up seedlings:									
Man labor	177.60	202.40	154.60	2.82	4.93	438.30	234.65	3.36	5.07
Transplanting:									
Man labor	591.00	428.40	603.50	8.42	14.72	1,508.80	1,152.30	13.42	20.23
Harvesting:									
Man labor	1,241.50	1,085.30	1,760.10	20.48	35.80	1,437.90	1,031.50	12.42	18.72
Shocking and stacking:[b]	166.46	188.46	302.22	3.22	5.63	796.38	1,035.18	9.39	14.16
Man labor	112.39	137.75	195.45	2.20	3.85	573.70	770.00	6.89	10.39
Animal labor	54.07	50.71	106.77	1.02	1.78	222.68	265.18	2.50	3.77
Total man labor	2,608.09	2,889.45	3,533.85	45.67	79.84	5,773.46	4,936.45	54.18	81.68
Total animal labor	526.37	782.52	1,053.50	11.53	20.16	1,153.14	1,232.44	12.15	18.32
Total labor	3,134.46	3,671.97	4,587.35	57.20	100.00	6,926.60	6,168.89	66.33	100.00
Man labor per ha.	51.82	46.16	39.03	45.67	79.84	55.14	53.22	54.18	81.68
Animal labor per ha.	10.46	12.50	11.64	11.53	20.16	11.01	13.29	12.15	18.32
Labor cost per ha.	62.28	58.66	50.67	57.20	100.00	66.15	66.51	66.33	100.00
Production per ha. (*capongos* or cavan)[a]	115.64	103.08	140.09	119.60	——	36.74	58.27	47.50	——
Labor cost per *capongo* or cavan (pesos)	0.54	0.57	0.36	0.49	——	1.80	1.14	1.47	——

[a] *Capongo* is the unit of measure used in Pangasinan.
Cavan is the unit used in Nueva Ecija.

[b] Cost of operation includes both man and animal labor.

TABLE 4

Labor and material requirement of a hectare of rice in Pangasinan and Nueva Ecija, 1926–1927

	PANGASINAN			AVERAGE	AVERAGE MAN LABOR REQUIRED		AVERAGE ANIMAL LABOR REQUIRED		NUEVA ECIJA		AVERAGE	AVERAGE MAN LABOR REQUIRED		AVERAGE ANIMAL LABOR REQUIRED	
	San Carlos	Mangaldan	Balungao						Peñaranda	San José					
					days	*per cent*	*days*	*per cent*				*days*	*per cent*	*days*	*per cent*
Number of farms	34	46	50						54	50					
Yield per ha. (*capongo* or cavan)[a]	115.64	103.08	140.09	119.60	.....	.....	.....	.....	36.74	58.27	47.50	.....	.....	.....	.....
Seed needed (*capongo* or gantas)[a]	2.20	3.31	2.10	2.54	.....	.....	.....	.....	20.82	19.27	20.05	.....	.....	.....	.....
Seed bed preparation:															
Man labor (days)	1.34	3.34	2.51	2.40	2.40	4.22	.....	.....	1.87	1.57	1.72	1.72	3.35	.....	.....
Animal labor (days)	1.34	3.34	2.51	2.40	.....	.....	2.40	16.04	1.87	1.57	1.72	.....	.....	1.72	10.08
Plowing field:															
Man labor (days)	8.11	10.06	5.46	7.88	7.88	13.85	.....	.....	6.65	7.76	7.20	7.20	14.03	.....	.....
Animal labor (days)	8.11	10.06	5.46	7.88	.....	.....	7.88	52.68	6.65	7.76	7.20	.....	.....	7.20	42.18
Harrowing field:															
Man labor (days)	2.30	3.99	3.79	3.36	3.36	5.90	.....	.....	4.89	5.18	5.04	5.04	9.83	.....	.....
Animal labor (days)	2.30	3.99	3.79	3.36	.....	.....	3.36	22.46	4.89	5.18	5.04	.....	.....	5.04	29.52
Pulling up seedlings:															
Man labor (days)	3.89	5.55	3.24	4.23	4.23	7.43	.....	.....	3.93	3.15	3.54	3.54	6.90	.....	.....
Transplanting:															
Man labor (days)	11.44	9.06	8.40	9.63	9.63	16.92	.....	.....	10.34	13.89	12.12	12.12	23.62	.....	.....
Harvesting:															
Man labor (days)	15.51	32.12	33.16	26.93	26.93	47.32	.....	.....	13.46	14.34	13.90	13.90	27.08	.....	.....
Shocking and stacking:															
Man labor (days)	2.83	2.00	2.61	2.48	2.48	4.36	.....	.....	7.09	8.51	7.80	7.80	15.20	.....	.....
Animal labor (days)	1.39	1.25	1.33	1.32	.....	.....	1.32	8.82	3.21	3.01	3.11	.....	.....	3.11	18.22
Total man labor (days)	45.42	66.12	59.17	56.91	56.91	100.00	.....	.....	48.23	54.40	51.32	51.32	100.00	.....	.....
Total animal labor (days)	13.14	18.64	13.09	14.96	.....	.....	14.96	100.00	16.62	17.52	17.07	.....	.....	17.07	100.00
Labor per *capongo* or cavan[a] (days)	.....	.....	.....	.....	0.48	.....	0.13	.....	.....	.....	.....	1.08	.....	0.36	.....

[a] *Capongo* is the unit of measure used in Pangasinan.

Cavan and ganta are units used in Nueva Ecija; 25 gantas equal one cavan.

SOME EXPERIMENTS ON FARM TANNING[1]

ILDEFONSO A. PALISOC

INTRODUCTION

In many parts of the Islands hides and skins can be bought at low prices, and when tanned, may be sold at a considerable advance. It would seem that a knowledge of some of the practical methods of tanning might be of value to farmers, for they have little work to do on the farm some periods in the year and tanning would give them a profitable occupation for these idle times.

Review of previous work

In spite of the importance of tanning hides as an occupation in the Islands, there has been little published on the subject. In some other countries, however, there is considerable published material on tanning. But the writer has limited himself to Philippine literature in reviewing past work and such publications as were consulted in connection with the carrying out of this work.

Of the work carried out in the Philippines, Gana (1915) states that the Filipino method of tanning hides is primitive and very inefficient. He advocates the use of a combination of camanchili and mangrove barks as tanning materials to produce a good quality of leather at moderate expense. According to Gana (1916) these barks are the only materials used in the Filipino method of tanning.

Frey, Clarke, and Veitch (1922) claim that the use of salt-alum and salt-sulfuric acid are satisfactory to use for home tanning of fur skins. They further state that the salt-alum process is slightly better than salt-sulfuric acid formula. These authors state that the leather produced by the salt-oxalic acid or any other mineral acid method is not durable. They contend that the leather produced by sumac or other similar tanning materials is unquestionably the best quality as to serviceability or durability, and is better than that tanned with hemlock bark or with similar tanning materials.

Object of present work

The object of this work was to determine efficient and economical formulae for tanning hides on the farm in the Philippines.

[1] Thesis presented for graduation, 1925, with the degree of Bachelor of Agriculture from the College of Agriculture No. 254; Experiment Station contribution No. 457. Prepared in the Department of Animal Husbandry under the direction of Dr. Valente Villegas, Assistant Professor of Animal Husbandry.

Time and place

In connection with these studies, two lines of investigation were carried out. One consisted of a preliminary investigation made on the industry in San Carlos and Binmaley, Pangasinan, and in the Philippine Tannery, Malabon, Rizal. The other consisted of actual experiments performed at the College of Agriculture, University of the Philippines.

The work was conducted from April, 1923, to February, 1925.

MATERIALS

Hides and skins of various classes of animals were used; namely, four and one-half cattle hides, one carabao hide, seven goat skins and one dog skin. All excepting two goat skins and one dog skin were divided into halves to afford more material for the different methods of tanning tried.

For the removal of hair, air-slaked lime was used. In both native and foreign methods this was used. Vinegar containing four per cent of acetic acid was used to remove the lime that adhered to the tissues of the hide or skin after dehairing and washing, thus insuring the pliability and cleanness of the hides and skins. Tanning chemicals were employed with all foreign methods of tanning; these consisted of sulfuric acid, alum, oxalic acid, borax, common table salt and green soap. In performing the native method of tanning the bark of camanchile (*Pithecolobium dulce* Bentham) was used. The bark was in the green state.

For purposes of stretching and drying the hides and skins, two pieces of board were used. Each board was about two meters long and one-half meter wide. On these boards hides and skins were stretched and nailed before drying.

Before the hides and skins were salted for curing, the fatty and extraneous tissues were removed with a knife. A bolo was used in stripping the bark off camanchile and in cutting it up into small pieces.

A piece of flattened iron 30 cm. long, bent at both ends so a wooden handle 12 cm. in length could be fastened to it was used to remove the hair from the skins and hides. The edge of this tool was dulled so as to prevent the cutting of the hides and skins in the process of scraping.

To facilitate the extraction of juice, the tan bark was disintegrated by pounding it in a mortar.

In the processes of dehairing and tanning, the hides and skins were soaked in earthen jars, each large enough to hold one-half of a cattle hide.

METHODS

Fleshing and cleaning

There was some flesh and other extraneous tissues on practically all hides and skins used and they were dirty. To prevent the deterioration of the skins and to let the curing, dehairing, and tanning materials penetrate

the skins most effectively, this flesh and other tissues were removed with a fairly sharp knife, great care being exercised that the skins were not injured. All dirt adhering to both the hair and flesh sides of the hides was washed off with water. The water was drained off by hanging up the hides.

Salting and curing

Salting is an important phase in the preparation of hides before tanning. Hides that are not properly salted at the right time are likely to rot and become unfit for tanning, or if used will make poor leather.

In the process of salting, each piece of the hide or skin was spread on a wooden floor with the flesh side up and the salt was sprinkled liberally and evenly all over the surface. Then the hide was folded with the flesh side in, and rolled up, and placed in a box and left over-night. The next morning it was unrolled and if the salt had been absorbed the skin or hide was spread out and more salt was applied, after which it was folded and rolled as before. This process was repeated for three successive days.

Both skins and hides that were properly salted, turned firm and hard, and were free from a disagreeable odor. The salt did not affect the hair at all. After the three days salting, the skin or hide was spread on a framework and exposed until fairly dry. In this condition the skins were kept until the dehairing and tanning materials were prepared.

Dehairing

So the dehairing material could penetrate the skin or hide, it was washed thoroughly to remove the salt and other foreign matter that had accumulated in the process of salting and drying. It was then immersed in water for twenty-four hours to soften the tissues, before it was dipped in a lime solution with a strength of 2.5 kilograms of lime for every fifty liters of water. As soon as the hair started to loosen so it could be easily scraped off, the skin was spread vertically on a board and the hair scraped downward until it all was removed. The skin was then turned over and the flesh side scraped to remove the fatty and other extraneous tissues.

Tanning

The following methods of tanning were employed in conducting these experiments:

Native method. The bark of camanchile was used in this method. The tanning extract was prepared by soaking for two days twenty-eight kilograms of bark in thirty liters of water. This process extracted the tanning principle from the bark.

When the lime and hair had been scraped from each skin it was folded; the skins were piled one upon the other and the whole completely immersed in the tanning solution. To facilitate the penetration of tanning extract a quantity of shredded camanchile bark was spread between the

layers of skin. The skins were examined daily and rearranged to insure proper and equal penetration of the tanning solution into the different tissues.

Foreign methods: 1. "Tanning a deer skin."—C. O. Ormsbee.

Dissolve alum in soft water at the rate of one pound (.45 kilogram) to four gallons (15.14 liters) of water. Soak the cleaned skin twenty-four hours, pulling and stretching frequently to avoid wrinkles which interfere with a uniform penetration. At the end of the twenty-four hours or a little later, wring the skin as dry as possible and spread on the floor with flesh side up. Sprinkle liberally with a mixture of equal parts alum and salt. Fold together, roll tightly and lay away for twenty-four hours. Then unroll, pull and stretch, the more the better. Sprinkle again with mixture, fold, roll and lay away. Repeat daily until skin will absorb no more. Ten days are generally required to tan.

2. *"Tanning leather"*—California Cultivator.

To each gallon (3.79 liters) of water, add one quart (0.95 liter) of salt and one-half ounce (14.17 grams) of sulfuric acid. Do not put in a metal container. Thin skins tan in this liquor in one day. Heavy skins take longer and can stay in quite long and not be injured. When removing skins wash in soapy water, wring dry and rub on the flesh side with a cake of soap. Fold in middle and hang lengthwise on outstretched line, hair side out, and leave to dry. When both surfaces are barely dry, the interior is fairly moist.

3. *"Tanning skins with and without hair"*—R. C. Hodgson.

Before tanning a skin, soak it well in a mixture made as follows: Take four gallons (15.14 liters) of cold soft water, one-half pint (458.05 cc.) soap, one-half ounce borax (14.17 grams), and one-half pint (458.05 cc.) salt; mix and immerse skins. If the hair or wool is to be left on, add three-fourths ounce of sulfuric acid. Soak from two to six hours. If the hair is to be removed, use a special dehairing formula.

Tanning liquor:—Eight quarts (7.6 liters) cold soft water, one-fourth pound (11.3 grams) pulverised oxalic acid, and one quart salt; dissolve well and immerse skins. Light skins require three to four hours, heavy skins forty-eight or more hours until tanned. This can be told by examining the thickest part.

DISCUSSION OF RESULTS

Time necessary for curing

The success in the production of a good quality of leather depends not only upon the method of tanning employed, but also upon the condition of the hide or skin and upon the way the work is done. Whalin, Frey, Veitch, and Hichman (1919) found that poorly cured hides become spoiled in the tanning liquor, this condition being detected by the presence of spoiled tissues. The writer observed that poorly cured hides may be detected after standing five days in lime solution by the forming of spots of decaying tissues. These decayed spots are soft and velvety in texture and have a disagreeable odor. According to the tanners in San Carlos and Binmaley, Pangasinan, if a hide or skin is not properly cured it is likely to rot after it has laid for three days in lime solution.

In the experiment reported in this paper one cattle hide was salted on each of the following dates: February 12 and 16, May 13, 1923, and January 5, 1924. These hides were kept in an empty kerosene box over-night, and by the next morning liquid material was found to be draining from them. The amount of this liquid became gradually less until the third day when the hides were just moist. At this time the texture of the skin was rather firmer than it was before the application of salt. No disagreeable odor developed during the time the skins were kept in the box, showing that no

fermentation or putrefaction had taken place. The hair was observed to adhere as firmly to the hide as it did when the skin was just removed from the body of the animal. Two days after the second application of common salt a slight degree of firmness and hardness of the skin was observed. As more salt was applied the harder the skin became until the fifth day.

According to Gana (1915) hides require from one to two weeks to cure. He advises that salted hides should be stored in a cool dark room where they could be protected from drafts. Whalin, Frey, and Hichman (1919) state that the application of salt should not be made until the seventh hour after the removal of the hides from the body of the animal; this time is necessary to allow the skin to cool. In places where the weather is cold a hide may be left unsalted over-night. These authorities further indicate that hides generally require from six to fourteen days to cure.

Time necessary for the removal of hair

Table 1 shows the average length of time required to remove the hair from the different hides or skins. The time required to remove the hair of cattle is twelve days; of carabao, eleven; and of goat, seven; all having been treated with the same concentration of lime solution. The difference

TABLE 1

The time necessary for the removal of hair from different hides

KIND OF HIDE	NUMBER OF HIDES, OR SKINS	TIME NECESSARY FOR THE REMOVAL OF HAIR
		days
Cattle	4½	12
Carabao	1	11
Goat	6	7

in time just referred to appears to be due to the difference in thickness; the thicker the hide the longer the time. It was observed that in all the cattle and carabao hides the swelling of the epidermal tissues and of the hide as a whole took place on the third day, and the hair began to slip off on the fifth day. These changes in the thickness and texture of the hides and the degree of loosening of the hair from the hides became more marked as the period in the dehairing process advanced. In the case of goat skins the swelling of the epidermal cells and the change in the texture of the skins were detected on the second day. The hair began to slip off on the third day using the same kind and concentration of dehairing solution as with the other skins. Swelling of hides was very marked on the seventh day when the hair on all portions could be rubbed off easily with a slight touch of the finger. According to Rogers (1915) the swelling of the epidermal tissues is due to the lime soap formed from the union of the lime and fatty matter of the hides, causing the hair to loosen and finally to slip off. It was further observed that in all hides there was formed a cheese-like substance that was scraped off with the hair during the dehairing process. Frey,

Clarke, and Veitch (1922) state that the presence of cheesy matter is an indication that the hide is sufficiently limed. It is further pointed out by these authors that the removal of hair from the hide requires from six to ten days in summer, and 16 days in winter in a lime solution made by dissolving 4.53 kilograms of caustic lime in 19 liters of water.

Time necessary for tanning

Native method. Seven pieces of hides from the three classes of animals, carabao, cattle, and goat, were tanned. The pieces were first soaked in water for two days, carefully examining each piece morning, noon, and afternoon. The water was changed during the soaking. After 12 hours in the water the hide began to become soft and pliable. This quality continued during the remaining 36 hours of soaking before the skins were put in the tanning solution. Local tanners claim that the removal of lime from the tissues of the hide makes it soft and pliable.

During the tanning process, observation was made morning and afternoon. A small cut was made along the edges of the hides, particularly at the thickest portions, and observations were taken on these cuts. As may be seen in table 2, in the case of the goat skins, it was six days before the material appeared completely tanned. Within this period of time there occurred marked changes in the color of the cross sections of the hide, from light gray to the dull light brown of tanned leather. With cattle and carabao hides, the cross section of the cut edges did not show any change in color until the seventh day when a distinct dark line was in evidence. This line disappeared gradually and slowly, requiring 25 days with cattle hides, and 34 days with the carabao hide, from the time the hides were put to soak in tanning solution (see table 2). At the end of these periods the color

TABLE 2

Results obtained with the native method of tanning

HIDE NO.	WEIGHT OF RAW HIDE	WEIGHT OF TANNED HIDE	LOSS IN WEIGHT		DURATION OF			
					Soaking in water	Dehairing in lime solution	Deliming in water	Tanning in camanchili extract
	grams	*grams*	*grams*	*per cent*				
Goat skin No. 1	208.2	150.0	58.8	28.22	1 day	7 days 4 hours	2 days	6 days 23 hours
Goat skin No. 2	152.2	110.0	42.2	27.72	1 day	7 days 4 hours	2 days	5 days 23 hours
Goat skin No. 3	104.2	75.2	28.7	21.01	1 day	5 days 1 hour	2 days	5 days 23 hours
Goat skin No. 4	175.0	115.0	50.0	28.57	1 day	7 days	2 days	6 days
Goat skin No. 5[a]	83.7	80.0	3.7	4.43	1 day	6 days	2 days	6 days
Carabao hide No. 1	8000.0	6900.0	1100.0	14.75	1 day	9 days	2 days	34 days
Cattle hide No. 1	300.0	205.0	95.0	31.67	1 day	9 days	2 days	25 days

[a]Goat skin No. 5 was in dry form.

was dull light brown. According to Gana (1915) this color of leather is due to the fact that the camanchile extract contains but little coloring matter.

During the immersion of the hides in the tanning solution a disagreeable odor developed, which according to Gana (1915) is caused by the putrefaction of nitrogenous compounds contained in the hides.

Hides of different species of animals require varying lengths of time to tan because of the difference in thickness of the hides; the thicker the material the longer the time required for the tanning solution to penetrate through it.

Foreign methods. In carrying out the foreign methods of tanning, all hides, excepting those that were tanned with the hair on, were soaked in vinegar for one day before they were immersed in the tanning solution. The concentration of the vinegar solution was one-half liter of vinegar to every 76 liters of water (Veitch, etc., 1922). The hides soaked in this solution were examined at three-hour intervals during the day time, and it was noticed that after six hours the hides were soft and pliable. These changes increased until the hides were removed and put in the tanning solution. Frey, Clarke, and Veitch (1922) who conducted experiments of a similar nature state that the softness and pliability of the hides are the result of the removal of lime contained in the tissues.

Foreign Method No. 1. "Tanning a deer skin"—C. O. Ormsbee (Sandhouse, 1922):

Cattle hides and goat skins were tanned by this method. The hides were first soaked in alum solution at the rate of 500 grams of alum to every 15.2 liters of fresh water. The hides were immersed for 24 hours during which time regular inspection was made to insure proper and even penetration of the solution into the tissues.

After the hides had been soaked in the alum solution, they were removed and hung under shade to drain over-night. Then a tanning mixture of equal parts by weight of alum and common salt was dusted on the flesh side. The hides were rolled and laid aside until the mixture had been absorbed. Beginning the next day the mixture was applied, continuing daily for one week. Then, because the tissues were about saturated with the mixture, at longer intervals until the hides appeared completely tanned. As may be seen in table 3 a cattle hide weighing 5600 grams required 26

TABLE 3

Results obtained with salt-alum method of tanning (Foreign Method No. 1)

HIDE NO.	WEIGHT OF RAW HIDE	WEIGHT OF TANNED HIDE	LOSS IN WEIGHT		DURATION OF			
					Soaking in alum solution	Dehairing in lime solution	Deliming in vinegar solution	Tanning in salt-alum mixture
	grams	*grams*	*grams*	*per cent*	*day*	*days*	*day*	*days*
Cattle hide No. 1	5600.0	3050.0	2550	45.53	1	12	1	26
Goat skin No. 1	400.0	165.0	235.0	58.75	1	12	1	12

days to tan, while a goat skin required only 12 days. Sandhouse records that with a deer skin it required ten days to tan it, the skin being daily stretched and dusted with the tanning mixture. The goat skin is about as light weight as a deer skin and required 12 days to tan it, applying the mixture four times.

Foreign Method No. 2. "Tanning leather"—*California Cultivator* (Sandhouse, 1922):

In testing this method of tanning, one piece of carabao hide, three pieces of cattle hides and one piece of goat skin were used. The hides and skins were immersed in a tanning solution made up of 38 liters of rain water, ten liters of common salt and 442 cubic centimeters of concentrated sulfuric acid. The weights of the lighter hides immersed in this solution were from 114 to 4200 grams; of the heavier, from 10,150 to 10,800 grams. As may be seen in table 4, the lighter hides tanned in 24 hours, while the heavier

TABLE 4

Results obtained with salt-sulfuric acid method of tanning (Foreign Method No. 2)

HIDE NO.	WEIGHT OF RAW HIDE	WEIGHT OF TANNED HIDE	LOSS IN WEIGHT		DURATION OF			
					Soaking in water	Dehairing in lime solution	Deliming in vinegar	Tanning in salt-sulfuric acid solution
	grams	*grams*	*grams*	*per cent*				
Cattle hide No. 1	4200.0	3200.0	1000	23.81	1 day	13 days 12 hours	1 day	1 day 15 hours
Cattle hide No. 2	10150.0	5354.0	4796	47.23	fresh	14 days	1 day	2 days
Cattle hide No. 3	10800.0	5645.0	5155	47.73	fresh	14 days	1 day	2 days
Carabao hide No. 1	1000.0	900.0	100	10.00	1 day	13 days 12 hours	1 day	1 day
Goat skin No. 1	114.0	95.0	19	17.41	1 day	9 days	1 day	1 day

ones took twice this length of time, or 48 hours. It is evident that the difference in the length of time consumed was because the tanning solution does not penetrate through the thicker hides as readily as through the thinner ones. Examination of the hides in the tanning solution showed that the hides gradually became soft and pliable with the flesh color fading. After removing a hide from the solution, however, and exposing it in sunlight the tissues became firm and strong.

Foreign Method No. 3-a and b. "Tanning skins with and without hair"—R. C. Hodgson (Sandhouse, 1922):

The hides without hair were first soaked for six hours in a solution made of 14.2 grams of borax, 250 grams of common salt, and 250 grams of soft soap dissolved in 15.2 liters of water. Three pieces of cattle hide were

used. Examination was made at two-hour intervals, and care was exercised so that the hides were equally and properly acted upon by the solution. After soaking for six hours, the hides turned white and were odorless. According to Rogers (1915), borax acts as a preservative. Thus, the white color and lack of odor of the hides were caused by the borax and salt contents of the solution.

The bleached hides were put in a tanning solution composed of 125 grams of oxalic acid crystal and 736.7 grams of common salt dissolved in eight liters of water. The hides were examined every morning, noon, and afternoon. In two days the different hides were found to be more pliable and whiter than before soaking them in the solution. Rogers (1915) states that oxalic acid is also a bleaching agent; hence, the whiter color. As may be seen in table 5-a, hides weighing less than one kilogram tanned in a shorter period of time than those weighing six kilograms or more.

Before the skins with hair were put in the tanning solution, they were soaked from six to eight hours in a solution made by dissolving 50 grams of green soap, three grams of borax, 50 grams of common salt and four and two-tenths cubic centimeters of concentrated sulfuric acid in three liters of water. Goat and dog skins were used. The skins were examined at two-hour intervals. At the end of six hours with the dog skin and eight hours with the goat skins, the hair was observed to be so firmly fixed that it was hard to pull off. According to Sandhouse (1922) the fixation of hair in the skins is caused by the presence of sulfuric acid in the solution. The goat and dog skins just referred to were afterwards immersed in a tanning solution. This solution was composed of 125 grams of oxalic acid and 736.7 grams of common salt dissolved in eight liters of water. The skins were inspected three times a day. At the end of two days they were found to be completely tanned. The leather produced by this method was soft and pliable.

TABLE 5-a

Results obtained with salt-oxalic acid method of tanning hides without hair (Foreign Method No. 3-a)

HIDE NO.	WEIGHT OF RAW HIDE	WEIGHT OF TANNED HIDE	LOSS IN WEIGHT		DURATION OF				
					Soaking in water	Dehairing in lime solution	Deliming in vinegar	Softening in salt-soap solution	Tanning in salt-oxalic acid solution
	grams	*grams*	*grams*	*per cent*	*day*	*days*	*day*	*hours*	
Cattle hide No. 1	800.0	400.0	400	50.00	1	12	1	6	4 hours
Cattle hide No. 2	6000.0	3300.0	2600	43.33	1	13	1	6	2 days
Cattle hide No. 3	7600.0	3780.0	3820	50.25	1	12	1	6	2 days

TABLE 5-b

Result obtained with salt-oxalic acid method of tanning skins with hair (Foreign Method No. 3-b)

SKIN NO.	WEIGHT OF RAW SKIN	WEIGHT OF TANNED SKIN	LOSS IN WEIGHT	DURATION OF	
				Hair preserving solution	Tanning in salt-oxalic acid solution
	grams	*grams*	*grams*	*hours*	*days*
Goat skin No. 1	200	200	0.0	8	2
Goat skin No. 2	300	300	0.0	8	2
Goat skin No. 3	328	328	0.0	6	2
Dog skin No. 1	600	600	0.0	6	2

Quality of tanned hides obtained by the different methods

Table 6 shows the quality of leather produced by the different methods of tanning. From the data there given the salt-alum method appears to be the best method, the leather obtained being very satisfactory. The tanned hides were bleached, odorless, hard and firm in texture. The hardness and firmness of the tanned hides were the result of the alum-ammonium content of the tanning material. The leather obtained with this method is slightly better than tanned hides obtained with the salt-sulfuric acid method, in so far as the permanency of the tanning effect is concerned.

With the salt-sulfuric acid method, as may be seen in table 6, the tanned hides were quite satisfactory, but not so good as those obtained with the salt-alum method. However, the leather produced by this method was soft and pliable and bleached and had no disagreeable odor. The main objection to this method is that the tanned hides absorbed moisture which induced fungi to grow and so damaged the leather after a time. In this condition there is a tendency for the leather to become very soft. The same observation was reported by Frey, Clarke, and Veitch (1922).

The tanned hides obtained with the salt-oxalic acid method of tanning without hair were bleached, hard and firm in texture, but those tanned with hair were very satisfactory. They were pliable and soft, and had no bad odor. The hair of the tanned hides with this method adhered as firmly as though the hides were in fresh condition.

The poorest quality of hides was produced by the native method. The product was dull light brown in color, loose in texture and with a disagreeable

odor. The light brown color in the tanned hide was caused by tannin that stained the hides.

TABLE 6

The quality of leather produced by different methods of tanning

METHODS	QUALITY OF LEATHER
Foreign method No. 1 Salt-alum	Best, bleached, odorless, hard, and firm in texture.
Foreign method No. 2 Salt-sulfuric acid	Good, bleached, odorless, soft, pliable; absorbed moisture.
Foreign method No. 3 Salt-oxalic—a	Medium, bleached, hard, firm and odorless.
Salt-oxalic—b	Very good, pliable, odorless, hair adhered firmly on the skin.
Native method	Poor, dull light brown, loose in texture, and with a disagreeable odor.

Loss in weight of tanned hides

In all the methods employed, the tanned hides, excepting those tanned with hair, lost much in weight. This difference may be attributed to the loss of hair, fatty and connective tissues, flesh, and other extraneous matter that were removed in dehairing, fleshing, and cleaning processes. There were also losses in the substances dissolved in the tanning solution. Table 2 shows that the loss in weight of tanned hides produced by the native method varied from 14.75 to 31.67 per cent, excepting in goat skin No. 5 where the loss in weight was only 4.43 per cent. This skin was extremely dry and well fleshed out before it was tanned. The average loss in weight of tanned goat skin was 21.99 per cent; of cattle, 31.67; and carabao, 14.75.

Table 3 shows that the loss in weight of cattle hides tanned by the salt-alum method was 45.53 per cent; of goats, 58.75 per cent. The average loss in weight with the salt-sulfuric acid method was 39.59 per cent for cattle hide; 10 per cent for carabao hide; and 17.41 per cent for goat skin. The average loss in weight with the salt-oxalic acid method was 47.86 per cent with cattle hides.

Of the four methods of tanning employed, the greatest average loss in weight, 47.86 per cent, was obtained with cattle hide tanned with the salt-oxalic acid method. The second greatest loss in weight, 45.53 per cent, was obtained with cattle hide tanned with the salt-alum process.

In tanning goat skins with the native, salt-alum, and salt-sulfuric acid methods, the highest loss, 58.75 per cent, was obtained with the salt-alum

method; the second highest average loss, 21.99 per cent, with the native method.

All skins tanned with the salt-oxalic acid method with the hair on, lost no weight at all (see table 5-b). These skins were cleaned and well fleshed out before putting them in the tanning solution.

Comparative cost of tanning hides

As may be seen in table 7, the total cost of tanning chemicals and other materials used in tanning one kilogram of hide with the different methods are as follows: ₱.46 with the native method; ₱.43 with the salt-alum method; ₱.17 with the salt-sulfuric acid method; and ₱.73 with the salt-oxalic

TABLE 7

The cost of tanning materials and labor to produce tanned hide by different methods

METHOD	NUMBER OF PIECES OF TANNED HIDE	WEIGHT OF TANNED HIDE	COST OF TANNING MATERIALS		LABOR COST		TOTAL COST OF TANNING MATERIALS AND LABOR	
			Total	Average per kgm.	Total	Average per kgm.	For all hides	Average per kgm.
		kgm.	*pesos*	*pesos*	*pesos*	*pesos*	*pesos*	*pesos*
1. Native	7	7.6352	3.54	0.46	1.44	0.19	4.98	0.65
2. Salt-alum	2	6.0000	2.56	0.43	0.89	0.15	3.45	0.57
3. Salt-sulfuric acid	5	26.2640	4.58	0.17	1.85	0.07	6.43	0.24
4. Salt-oxalic acid	7	15.2285	11.12	0.73	2.86	0.12	13.98	0.85

acid method. It is evident that the cost of material to tan hides by the native method is greater than by the salt-alum and salt-sulfuric acid methods but lower than by the salt-oxalic method, which is highest in cost of tanning materials. The lowest cost of materials was obtained with the salt-sulfuric acid method.

The labor cost was computed on the basis of one peso a day of nine working hours. According to table 7, the labor costs of tanning one kilogram of hide are as follows: ₱.19 with the native method; ₱.15 with the salt-alum method; ₱.07 with the salt-sulfuric acid method; and ₱.12 with the salt-oxalic method. According to these figures, the labor cost with the native method is the highest. With the foreign methods, the salt-alum method gave the highest labor cost per kilogram, but the most satisfactory quality of product was obtained by this process. The salt-sulfuric acid process gave the lowest labor cost.

Net returns accruing from tanning hides

Table 8 shows that the costs of one kilogram of tanned hide are as follows: ₱1.25 with the native method; ₱1.18 with the salt-alum methods; ₱0.75 with the salt-sulfuric method; and ₱1.50 with the salt-oxalic acid method. It follows that the cost of tanned leather is greater with the

native method than with the foreign methods, excepting the salt-oxalic acid method; that is, to tan by the native method is less economical than by the salt-alum and salt-sulfuric acid methods. Besides being cheaper the two last named methods give a better quality of tanned hides. Considering all the methods, tanning by the salt-sulfuric acid process is the most economical, and by the salt-oxalic method the most expensive of the methods used in this experiment.

From an investigation on prices of leather made by the writer on November 16, 1923, at the Philippine Tannery, Malabon, Rizal, one kilogram of the poorest quality of tanned hide produced in this establishment was ₱1.80. With this quotation as a standard (see table 9) the highest gain, ₱1.05 per kilogram of leather, was obtained with the salt-sulfuric acid method. The second highest, ₱.62, was with the salt-alum process. The least gain, ₱.30, was obtained with the salt-oxalic acid method. The native method gave a return of ₱.54, although the greatest labor expense was incurred in its production.

TABLE 8

The net returns accruing from the different methods of tanning

METHODS	WEIGHT OF RAW HIDE	INITIAL COST		SELLING PRICE OF TANNED HIDE	NET GAIN	
		Cost of raw hide	Cost of tanning		Total	Per kgm. of hide
	kgm.	*pesos*	*pesos*	*pesos*	*pesos*	*pesos*
Native	7.6352	4.60	4.98	13.74	4.16	.54
Salt–alum	6.0000	3.65	3.45	10.80	3.70	.62
Salt-sulfuric acid	26.2640	13.15	6.43	47.28	27.70	1.05
Salt–oxalic acid	15.2285	8.85	13.98	27.41	4.57	.30

SUMMARY AND CONCLUSION

It is not the intention of the writer to claim that the results obtained in this work are comprehensive and final. But it is certain that the present investigation indicates the practicability and possibilities of this particular line of work. It should stimulate greater interest in carrying out more extensive experiments along the same line.

The principal observations in this work were:

1. Cattle hides were found to cure well in five days.

2. It required practically the same length of time, 11 to 12 days, to remove the hair from cattle and carabao hides; it took seven days with goat skins.

3. Two days were required to remove the lime from the hide with the native method. With the foreign method, using vinegar, the lime in the skin was removed in only one day.

4. By the native method it took six days to tan goat skin; 25 days with cattle hide; and 34 days with carabao hide. Of the foreign methods: with the salt-alum method, cattle hide tanned in 26 days and goat skin in 12 days; with the salt-sulfuric acid method, cattle hide tanned in about two days and a carabao hide and a goat skin in one day; with the salt-oxalic acid method, cattle hide without hair generally took two days and goat and dog skins with the hair on, two days also.

5. The best quality of leather produced was by the salt-alum method; next best, by the salt-sulfuric acid method and salt-oxalic method-b. Leather produced by the oxalic acid method-a was medium in quality, while the poorest kind was obtained by the native method.

6. The lowest percentage of loss in weight was with leather produced by the salt-sulfuric method and the highest percentage was by the salt-alum method. Skins tanned with the hair on did not lose in weight.

7. The lowest total cost of tanning materials was obtained with the salt-sulfuric acid method and the highest cost was with the salt-oxalic acid method.

8. The lowest labor cost in the production of leather was by the salt-sulfuric acid method, and the highest by the native method.

9. The highest gain was obtained with the salt-sulfuric acid method, and the lowest was with the salt-oxalic method.

10. Although the cost of production of leather by the salt-alum method was not the lowest, yet because of the good quality of product obtained by this method it is safe to say that the highest net gain could be obtained by this method.

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ABSTRACT[1]

The effect of leaf cutting upon the production of rice. ISIDORO ANDAYA. (*Thesis presented for graduation, 1926, from the College of Agriculture, No. 255; Experiment Station contribution No. 458*).—The object of the author was to find the effect upon the yield of rice in grain, straw, and number of panicles produced: (*a*) when part of the leaves of rice were cut at different ages; (*b*) when part of the leaves were cut more than once at different ages.

The experiment was carried out in a rice paddy at the College of Agriculture for almost seven months in the year 1926. The paddy was divided into 15 sets of culture plots. Each plot had an area of 39 square meters and was rectangular in shape. The paddies were prepared in the usual manner. The seedlings of Murmuray, a lowland variety of rice, were used, allowing one seedling in a hill which were at a distance of 2.5 cm. each way. After transplanting, each plot was given the same cultural treatment throughout the progress of the experiment.

The results show that the first method employed prolonged the flowering stage when the leaves were cut when the plants were from 65 to 67 days old, but it gave slight effect if the seedlings treated were younger. The weight of the panicles was also found to be greater than those of either the check plots or the plots treated with cutting part of the leaves more than once at different ages. However, the age for cutting the leaves that gave the greatest yield was when the seedlings were 37 days old, beyond this age there was a gradual decrease of yield, weight of straw, and number of fruiting culms. The repeated cuttings, or the second method employed, caused the maturation of the plants to be more uniform than in the single cutting treatment. The yield of grain was greatly reduced, inasmuch as a fewer number of fruiting culms were produced by the plants.

The single cutting produces from 58 to 91 bales of rice hay to the hectare; the repeated cuttings, from 51 to 95 bales. The calculation was made, considering one bale of rice hay to be equal to one bale of American wheat hay that weighs 74 kilograms. One bale of rice hay with grain costs ₱5.00 in Manila. From this approximate cost, the value of rice hay from one hectare of the different varieties of rice in the Philippines varied from ₱37.00 to ₱640.50.

—*Abstract by V. C. Lopez.*

[1]Abstract prepared as part of required theme work in English 6, College of Agriculture.

EXTENSION DIVISION NOTES

Regarding the New College Copra Drier

Mr. P. Zimmerman, Plantation Manager, Cabano Coconut Estate, Inc., at Jordan, Guimaras Islands, Iloilo, reports that under his own direction a copra drier was recently built in the Estate to replace the old type drier generally used in the Islands. In building the new drier, Mr. Zimmerman followed exactly the plan and specifications explained in detail in the College Experiment Station Circular No. 11, but used more costly materials so as to make his drier more solid and more durable than the one constructed at the College. He spent ₱1,500 for the whole outfit which includes the drier and the shed for protection, as against ₱282.05, the cost of one of permanent type estimated on the basis of local prices by the College for a drier of 1,000 nut-a-day loading capacity. Mr. Zimmerman expresses his satisfaction with the result of his new drier as he now can make copra of higher quality than formerly and can do the work at any time of the year, regardless of weather changes. Formerly, as his report says, it was not possible for him with the use of the old native drier to produce so good a quality of copra, and when he resorted to sun drying he found this process to be expensive and not dependable on account of the uncertainty of the weather. Thus far he has dried 65,050 nuts in his new drier, which under Iloilo conditions gave him 240.75 piculs of copra.

Under the supervision of Prof. Hilarion Henares of the Chemistry Department, College of Agriculture, two copra driers were set up at Lucena, Tayabas, for the Provincial Board of the same province on the initiative of Governor Perez. An adequate appropriation for this purpose was made by the Provincial Board. The construction of the driers was under the immediate direction of District Engineer Bagtas who reported that the drier for which cheap material was used cost ₱268.61 and the other one made of stronger material cost ₱594.57, and the shed—as the driers were built side by side one did for both—had cost ₱562.39—or a total of ₱1,425.57. This amount includes expenses for material, labor and supervision and surcharges of the province. No report has been received from Governor Perez on the actual test made of these driers.

The other copra drier reported to have been set up following the College demonstration is the one on the *hacienda* of Mr. Leon Katigbak in the barrio of Tijero, Lipa, Batangas. This drier is intended by Mr. Katigbak for a trial in drying peanuts, as he has found it difficult to dry them when harvested on rainy days. At the same time it will serve as a model for

Lipa farmers who are interested in building one for themselves for copra making.

There have been several requests received from farmers in other coconut-producing districts in the Philippines to supply them a College specialist to personally direct the construction and operation of the College New Copra Drier. These requests were from Mindoro, Masbate, Albay, and Lanao. But lack of proper personnel has made it impossible to meet these requests as early as was desired. However, copies of the College Experiment Station Circular No. 11, and further explanation of the plan and specifications were furnished the interested parties so as to enable them to set up the drier by themselves.

Quite a number of personal visits were made by various farmers from the different parts of the Islands to examine the drier on the College Campus. These particular farmers found this practice to be helpful to them in following the specifications contained in Circular No. 11. Any one so interested is welcome on the College Campus. It is understood that the same reception will be given farmers who may wish to visit any of the privately owned driers mentioned above.

We know that the invention and the demonstration of the College Copra Drier last year was not a turning point in the improvement of Philippine copra, but from the demands we receive from farmers for information regarding the College Improved Drier we can claim that we have kindled the interest of the Filipino coconut grower in improving the quality of Philippine copra.

A Girl Farmer

During a recent trip to the island of Leyte by two professors from the College of Agriculture studying agricultural conditions in that island, they met on an outlying abaca plantation—out in the country of the barrio of Alahag, Jaro, Leyte—a girl by the name of Rosa Trota. The attention of the party was particularly attracted by the hard task being performed by the girl. Clad in a simple European dress of the ordinary school fashion, squatting barefooted with a bolo scabbard tied around her waist, she was cleaning with a bolo an abaca plantation from weeds that had overgrown since the last harvest. In answer to inquiries, she told the party in fluent English that the plantation belonged to her family and that she was working as hard as she could in order to set the right example to a bunch of men whom she hired to help her clean the plantation. She is twenty-one years of age, is a third year student in the Normal Department of the Leyte High School. Her father being dead, as the eldest of the family she has to take her father's place in farm work so as to aid her mother in providing the living for the family from their land resources. The family has a piece of rice land and an abaca plantation from which they derive their income. The raising of the crops has fallen largely on Rosa's shoulders as

her mother is occupied with household tasks and the business side of farm management.

At the time of the professors' visit was the school vacation and Rosa was using the days putting her abaca plantation in good shape. When the school is in session she uses her school holidays in looking after the rice crop and such other farm work as does not interfere with her studies. It is said that owing to her unusual activities in local farming—managing as well as performing actual farm work—she has been offered by government officials an appointment as agricultural agent. But she has not made up her mind to accept a government job as her studies as well as the farm work are absorbing all her attention, and there is no one in her family, except her mother, old enough to run their farm business.

Regardless of the fact that Miss Trota had to do the work because she had lost her father, still her eagerness and ability to do what is generally looked upon as a man's job are quite appealing. Her example is one that might well be emulated by many of our students who return home every long summer vacation for a rest from their school work. Such a rest may be but a change of work which together with occasional merry-making affairs will surely make for a worth while and profitable relaxation from a year's work in school or college.

Two Former Students of the College of Agriculture

During the trip to Leyte of the two professors mentioned above, Mr. Mauro G. Rodriguez and Mr. José Mendoza, two former students of the College were met. They are both from Pangasinan and are employed by the Bureau of Agriculture for the province of Leyte as Agricultural Extension Agents. Mr. Rodriguez is in charge of extension work for the whole province and Mr. Mendoza is in charge of the Provincial Experiment Station located at Jaro, Leyte. It is interesting to note that while their salary is borne by the Insular Government, their traveling expenses as well as the expenses of the provincial experiment station are met by the province of Leyte. Provincial government officials, particularly the governor of Leyte, speak very highly of the work of both employes as of great benefit to the province. Mr. Rodriguez has traveled throughout the province to study local agricultural conditions and to help farmers solve some of their local problems. The Provincial Board has given him an office in the provincial building and depends upon him for advice in agricultural matters. Mr. Rodriguez is credited with originating Administrative Order No. 52 "containing regulations governing the removal and disposal of sawdust, manure, decaying stumps of coconuts and buri palms, bagasse and other vegetable matter or rubbish, and declaring the black beetle (*Oryctes rhinoceros*) to be a dangerous plant pest". It was mentioned that the issuance of this order started with written suggestions given by Mr. Rodriguez to the Municipal Council of Abuyog, Leyte, which in turn embodied them in a municipal

resolution sent to the Governor General in 1925. Mr. Mendoza is principally engaged in propagating plants at the Provincial Experiment Station for sale to farmers or for co-operative work with them in large plantings.

Mr. Rodriguez stayed at the College as student from 1914 to 1917 inclusive. In his junior year he left the College and went to the Bureau of Agriculture as Junior Agricultural Assistant and held this job for three years. Having saved enough to cover his transportation he went to the United States and entered Montana State Agricultural College as a self-supporting student. While pursuing his course in that college from 1921 to 1924 he was employed first as seed grader in the Seed Laboratory of the Montana Experiment Station and then as student assistant in the entomology and zoölogy department in connection with field work on grasshoppers. He graduated from Montana College as B. S. in Entomology and Zoölogy in 1924 and returned the same year to the Philippines and has been employed by the Bureau of Agriculture as agricultural extension agent since May 15, 1925.

Mr. Mendoza was in the College from 1916 to 1918 as a student. Because of failing health he left College and found a job in the Bureau of Agriculture. First, he was appointed as Junior Agricultural Assistant and then promoted to Agricultural Extension Agent, the position which he is now holding. He is planning to come back to the College to finish his course.

Fruit Preservation

The Bureau of Science should be commended for the success of its food preservation campaign. It is not uncommon now to see stores of preserved fruits, which in the past would have gone to waste, in many Filipino homes. Some are deriving income from sale of preserved fruits. In large towns home-made-preserves are for sale in many stores. Recently an *hacendero* from Batangas who is sending his preserved fruit to Manila, borrowed a sterilizer from this College to be used in food preservation. All these activities are the result of the campaign conducted by the Bureau of Science. For the first time in the history of the country fruit is becoming an important commercial product.

In this connection we may note the loss of an important industry in Bataan through the closing of the cannery in that province. For several years a fruit canning factory flourished in Orion, Bataan. They canned many kinds of fruit, but mostly pineapple, mango, and guava, and sent them direct to foreign markets. It was a good advertising medium for Philippine fruit. But the factory was suddenly closed in 1923. No definite information was made known as to the cause of the closing.

EXCHANGE NOTES

Dr. A. F. Woods, director of scientific work of the department, addressed one of the sessions of the Conference on Public Administration which was held in Washington on April 19–20 under the auspices of George Washington University.

The object of the conference was to promote a clear understanding of the policies and activities of the various branches of the Federal Government, and to make available to members of the college and University faculties the funds of information contained in the various departments of the Government.

The holding of such a conference was suggested by Dr. William Mather Lewis, president of the University, and it is the intention to make the conference annual. This first conference was attended by presidents and professors of political science, history, and sociology of some 40 colleges and universities of the country. Many high officials of the Government addressed the delegates on the work of their departments and agencies.

In his address, Doctor Woods gave a thorough outline of the activities of the Department of Agriculture.

"The research project of the States and the Federal Government involve an annual expenditure of about $20,000,000, about evenly divided between the States and the Federal Government," he said. "The economic returns, so far as they can be measured, are very large, now amounting to more *each year* than the entire expenditure for all the work of the department and the colleges from their *foundation to the present time*".

—*The Official Record* (U. S.).

The Filipinos make five kinds of muscovados. They put it in "Bayons," sacks made out of "buri" which comes from palm leaves. The Chinese buy this a lot and the correspondent saw it in some of the remoter places of the empire, where it had been subjected to dust and dirt and seemed absolutely impossible from an American point of view. Were it not for the inherent goodness of the sugar crystal this product would kill off a lot of people and we are not so sure that this does not happen to consumers of the tainted product. * * *

Twenty per cent of the mills in the Philippine Islands are manned by American capital. American capitalists have rather urged the Filipino to subdue his own land and invest his own money. No people are permanently happy who have to constantly depend on outside capital to work their industries, for the profit motive engenders feelings that do not work for the best relationships and no matter how fair moneyed men may be the sting of this criticism always awaits them.

—*The Planter and Sugar Manufacturer.*

Cheese is one of the oldest forms of food used by man. Its use is probably almost, if not quite, as old as that of wine.

The amount of cheese consumed annually per head of population in New South Wales is about 3 1/2 lb., while in England the consumption approximates 10 lb. per head.

—*The Agricultural Gazette* (New South Wales).

The grape fruit which is a favorite in the United States of America is also fast becoming a popular fruit in other countries of the world. The imports into the United Kingdom were six times as large in 1924 as in 1920, and the demand is continuing to increase. South Africa has taken up the cultivation of grape fruit extensively and is now making, together with the British West Indies, regular exports to the United Kingdom. The growing of grape fruit is also extending in Australia, but the exports up to date are comparatively small, says the Department of Agriculture, *Ceylon, Leaflet No. 41.*

—*Reprinted in The Planter* (F. M. S.).

The use of some preservative will help greatly in the preservation of lumber under fungus-favoring conditions. Painting the interior of a poultry house leads to the elimination of those conditions that stimulate the growth of wood-destroying fungus in a house.

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Wood is subject to the attacks of various fungi which are living organisms that prey upon the wood fibre.

A better understanding of what wood decay really is would make a poultry-man willing to spend for more paint some of the money that must otherwise be spent in repairs or in building a new house when the old one prematurely decays. It was not age that decayed his buildings—it was the fungi and his own ignorance working as partners.

—*American Poultry Journal.*

Did it ever occur to you that young chicks, like babies, require a lot of sleep? When chicks are brooder-raised, it would be a good plan to remember this and arrange some darkening process by which the chicks would be encouraged to take "40 winks" frequently during the day.

—*Cultivator* (California).

COLLEGE AND ALUMNI NOTES

Professor W. E. Hoffman, head of the biology department of Canton Christian College, was a Campus visitor during the greater part of July. He is conducting investigations on the water bugs, numerous interesting forms of which are found in Molawin Creek and other bodies of water near by. Professor Hoffman has done extensive work on these insects in China.

The Department of Animal Husbandry completed the installation of a one-ton ice plant June 13. In addition to ice, pork is now available for sale at the department at all times. A refrigerator will be installed in the near future. When this is completed, other kinds of meat will also be on hand for sale.

Friends of Professor Higgins will be interested to learn that he is now Agronomist of the Panama Canal Zone and working under very favorable circumstances. His address is Balboa Heights, Panama Canal Zone.

The following note about one of our faculty members appeared in *Berkeley Daily Gazette*, April 21, 1927:

The accidental discovery that juice flows from the Para rubber tree in the Philippines when the surface is scratched has led to an exhaustive research on the subject by Dr. Eduardo Quisumbing, associate in botany at the University of California who is on leave from the University of the Philippines where he is assistant professor of plant physiology in the College of Agriculture.

Although the anatomy of rubber trees has been investigated in various countries for years, the fact that tubes containing rubber juice arise almost to the surface of the tree was reported for the first time by Dr. Quisumbing.

Laticiferous vessels, or tubes of rubber juice, occur in the pith in young stems, in seedlings, in the leaves, and also in the roots, according to the reports by Dr. Quisumbing, published by the University of California Press. Such tubes may have two origins in the mature bark: one in the deep cortex, surrounded by a solid, hard portion of the tree known as the "stone ring", the other, outside this stone ring near the surface of the tree. The rubber-giving tubes on one side of the stone ring are totally separated and have an entirely different origin from those on the other side.

The new members of the Department of English staff are Miss Caroline Virginia Lee and Miss Esther A. Anderson. Miss Lee was graduated from Peabody Normal College, University of Nashville, and has been teaching for some years in James Sprunt Academy, Kiangyin, China. Miss Anderson was graduated with degree A. B. from University of California; graduate work in English and history was carried in Summer School, University of Southern California. Miss Anderson has been teaching in San Pedro High School, in Los Angeles School System.

Rev. Hugh Bausman is now resident pastor for Presbyterian Chapel at the College. For the past three years Mr. Bausman has been in charge of a mission on Hainan Island, China.

Dr. Deogracias V. Villadolid reported for duty in the Department of Entomology on June 9. He recently returned with Mrs. Villadolid from the United States where he had been sent as a University Fellow in agricultural zoölogy at Stanford University. He completed the requirements for doctorate of philosophy and in addition sports a Sigma Xi key. He had a chance to visit a number of American and Japanese scientific institutions before his return home.

A United States Army Motor Cycle Corps camped on the Campus two days in June. The Corps was out for training in "hiking" and motor transportation. Lieutenant Aldrich, graduate from the Houghton School of Mines, was in command. He was in the Flying Corps in the War. The Corps under the guidance of Lieutenant Aldrich spent one profitable forenoon in the College laboratories.

The thesis of Mr. Ernesto Montinola, B. S. '27, on "Earle Method vs. Ordinary Method of Treating Ratoons" appeared in the April number of *Sugar News*. In the May number of the same journal appeared articles by Dr. Manuel L. Roxas and Dr. Elias H. Panganiban, both of Department of Agricultural Chemistry. Doctor Roxas reported on "P. S. A. Experimental Work on Luzon" Doctor Pañganiban's paper was on "A Few Facts on Symbiolic Nitrogen Fixation."

Mr. Eldiberto Punzalan, B. S. A. '24, graduate assistant in Agronomy, resigned to accept position as assistant agriculturist with the Victorias Milling Co.

Artemio Manza, B. S. A. '23, formerly graduate assistant in Plant Physiology, now studying in University of California, Berkeley, writes Dean Baker of his arrival and welcome by Doctor Quisumbing, his former Chief in the College.

Mr. Dionisio Aquino, B. S. A. '23, now a student in State Agricultural College, Ames, Iowa, writes Dean Baker that he passed the oral examination for Master of Science and is planning for further study in the College. Mr. Aquino requested that seeds of legumes be sent him for work on a problem in cross inoculation that was suggested to him by his major professor.

Mr. Primo San José, B. Agr. '23, now teaching in the Piang Agricultural School, Kudarangan, Cotabato, writes Mr. Capinpin of his work and hopes of getting land in that new region. He shows his estimate of the value of the work in the College by sending a younger brother here this year.

Also, Mr. San José sent in his subscription for THE PHILIPPINE AGRICULTURIST.